ILLUSTRATED ELECTRICAL REVIEW

A Journal of Scientific and Electrical Progress.

VOL. 22. No. 15. WEEKLY. | NEW YORK, SATURDAY, JUNE 3, 1893. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1893, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

At a meeting of the Pittsburgh Electric Club last week President Morris Mead presented the following communication: "In consequence of the unpleasant and unfortunate notoriety produced by charges being preferred against me, and thinking it might be a detriment to the best interests of the Pittsburgh Electric Club to retain the position, I herewith hand in my resignation as president, feeling that this action may simplify matters until such time as my name is cleared." The following resolution was adopted by the directors:

Resolved, That the resignation be accepted, the board desiring it should be understood that the vacancy will be held open for his re-election until the circumstances referred to in the resignation be cleared up.

Now the telephone girls are to be put in uniform. An order was promulgated last week by the Chicago Telephone Company putting all their employés at the World's Fair grounds in blue. Even the local officers of the company are included in the general order, and will soon appear uniformed cap-a-pie in messenger boy blue. The girls are to wear blue serge dresses without any ornamentation in the way of gilt braid or buttons.

In the Pinna process of electric tanning the hides are submitted to the action of alternating currents while immersed in the tanning liquor. It is claimed that the skins are perfectly tanned by this method in the short period of 100 to 400 hours.

Governor Flower has vetoed Assemblyman Rivenburg's bill authorizing the State Board of Claims to audit the claim of the Western Union Telegraph Company for taxes levied in 1881 by the State Comptroller upon the entire capital stock of the company. The company at the time held that they should only be levied upon that portion of its capital stock employed in this State. In 1885 the legislature passed an amendment to the tax laws providing that the tax referred to should only be levied upon that portion of the capital stock of a corporation employed within this State. The amount involved in the Western Union claim had been stated to be in the neighborhood of $175,000.

Rapid transit has brought with it an unlooked-for annoyance to passengers. Clouds of dust follow the quickly running cars, pouring in at the doors and windows, and making travel almost insufferable. The inconvenience arising from this source is very great within the radius of paved streets, but when the cars pass beyond these out to the dirt roads of the suburbs, the dust is suffocating and well nigh unbearable. Who is going to be the fortunate inventor of an automatic dust laying device?

An unusual damage suit has been filed in the Circuit Court in Louisville, Ky., by C. C. Woodbury against C. C. Mengel, Jr. & Bros. Company. Woodbury was a brakeman on the N. N. and M. V. Railroad. He states that on May 18, 1892, at Trimble, a railroad station in Dyer county, he was hurled from a car by a telephone wire stretched across the track. The wire was suspended between Trimble station and the saw mill of the defendant company, but so negligently as, it is alleged, that it hung low over the track, and as the car on which the plaintiff was riding passed underneath, it caught him and threw him off. His arm was broken and various other injuries were sustained, for which he asks damages in the sum of $1,900.

The electric railway company of St. Joseph, Mich., will require the motormen and conductors to give bonds holding them responsible for any damage that may occur through neglect or carelessness on their part. They will also be asked to give bonds for their punches and the cash they carry.

"Kerite" at the World's Fair.

W. R. Brixey, manufacturer of Day's Kerite insulated wires and cables, has a very handsome display in the gallery at the southeast corner of the Electricity Building, Jackson Park, occupying a space of 1,060 square feet, which is enclosed by a fine brass railing, within which is built a very beautiful reception room and office where their friends and customers visiting the Fair will at all times be welcome. Their display consists of their well known specialties, such as submarine cables armored, from 1 to 10 conductor for telephone use; also cables from 2 to 154 conductor for underground telegraph lines, and aerial conductor cables, including the size as used for the block system on the N. Y. C. & H. R. R. R., and which required over 300 miles of this cable to build. The cables are nicely arranged on reels, and in several handsome show cases they display samples of wires and cables in all sizes cut from stock and nicely mounted, to be used for paper weights, which will be given away to their friends and customers. They also exhibit samples of Kerite tape, rubber covered wire for all purposes, wound with various colored braids to match woodwork and decorations for fine inside work. They also show samples of rubber in various forms, from the plant to the compound used in covering the wire. The exhibit was installed under the supervision of Mr. A. P. Eckert, who will be in charge during the Exposition. Mr. Eckert should feel much pleased with his efforts, as the exhibit is the best arranged, the most artistic and attractive display in the gallery.

"KERITE" EXHIBIT AT THE WORLD'S FAIR.

On Light and Other High Frequency Phenomena.

A LECTURE DELIVERED BEFORE THE FRANKLIN INSTITUTE, AT PHILADELPHIA, FEBRUARY 24, 1893, AND BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT ST. LOUIS, MO., MARCH 1, 1893, BY NIKOLA TESLA.

INTRODUCTORY — SOME THOUGHTS ON THE EYE.

When we look at the world around us, on Nature, we are impressed with its beauty and grandeur. Each thing we perceive, though it may be vanishingly small, is in itself a world, that is, like the whole of the visible universe, matter and force governed by law — a world, the contemplation of which fills us with feelings of wonder and irresistibly urges us to ceaseless thought and inquiry. But in all this vast world, of all objects our senses reveal to us, the most marvelous, the most appealing to our imagination, appears no doubt a highly developed organism, a thinking being. If there is any thing fitted to make us admire Nature's handiwork, it is certainly this inconceivable structure, which performs its innumerable motions in obedience to external influence. To understand its workings, to get a deeper insight into this Nature's masterpiece, has ever been for thinkers a fascinating aim, and after many centuries of arduous research men have arrived at a fair understanding of the functions of its organs and senses. Again, in all the perfect harmony of its parts, of the parts which constitute the material or tangible of our being, of all its organs and senses, the eye is the most wonderful. It is the most precious, the most indispensable of our receptive or directive organs — it is the great gateway through which all knowledge enters the mind. Of all our organs, it is the one which is in the most intimate relation with that which we call intellect. So intimate is this relation that it is often said that the very soul shows itself in the eye.

It can be taken as a fact, which the theory of the action of the eye implies, that for each external impression, that is, for each image produced upon the retina, the ends of the visual nerves, concerned in the conveyance of the impression to the mind, must be under a peculiar stress or in the vibratory state. It now does not seem improbable that, when by the power of thought an image is evoked, a distinct reflex action, no matter how weak, is exerted upon certain ends of the visual nerves, and therefore upon the retina. Will it ever be within human power to analyze the condition of the retina when disturbed by thought or reflex action, by the help of some optical or other means of such sensitiveness, that a clear idea of its state might be gained at any time? If this were possible, then the problem of reading

one's thoughts with precision, like the characters of an open book, might be much easier to solve than many problems, belonging to the domain of positive physical science, in the solution of which many, if not the majority, of scientific men implicitly believe. Helmholtz has shown that the fundi of the eyes are themselves luminous, and he was able to see, in total darkness, the movement of his arm by the light of his own eyes. This is one of the most remarkable experiments recorded in the history of science, and probably only a few men could satisfactorily repeat it, for it is very likely that the luminosity of the eyes is associated with uncommon activity of the brain and great imaginative power. It is fluorescence of brain action, as it were.

Another fact having a bearing on this subject which has probably been noted by many since it is stated in popular expressions, but which I cannot recollect to have found chronicled as a positive result of observation is, that at times, when a sudden idea or image presents itself to the intellect, there is a distinct and sometimes painful sensation of luminosity produced in the eye, observable even in broad daylight.

The saying then, that the soul shows itself in the eye, is deeply founded, and we feel that it expresses a great truth. It has a profound meaning even for one who, like a poet or artist, only following his inborn instinct or love for Nature, finds delight in aimless thoughts and in the mere contemplation of natural phenomena, but a still more profound meaning for one who, in the spirit of positive scientific investigation, seeks to ascertain the causes of the effects. It is principally the natural philosopher, the physicist, for whom the eye is the subject of the most intense admiration.

Two facts about the eye must forcibly impress the mind of the physicist, notwithstanding he may think or say that it is an imperfect optical instrument, forgetting that the very conception of that which is perfect or seems so to him, has been gained through this same instrument. First, the eye is, as far as our positive knowledge goes, the only organ which is directly affected by that subtle medium, which as science teaches us, must fill all space; secondly, it is the most sensitive of our organs, incomparably more sensitive to external impressions than any other.

The organ of hearing implies the impact of ponderable bodies, the organ of smell the transference of detached material particles, and the organs of taste, and of touch or force, the direct contact, or, at least, some interference of ponderable matter, and this is true even in those instances of animal organisms, in which some of these organs are developed to a degree of truly marvelous perfection. This being so, it seems wonderful that the organ of sight solely should be capable of being stirred by that, which all our other organs are powerless to detect, which yet plays an essential part in all natural phenomena, which transmits all energy and sustains all motion and, that most intricate of all, life, but which has properties such that even a scientifically trained mind cannot help drawing a distinction between it and all that is called matter. Considering merely this, and the fact that the eye, by its marvelous power, widens our otherwise very narrow range of perception far beyond the limits of the small world which is our own, to embrace myriads of other worlds, suns and stars in the infinite depths of the universe, would make it justifiable to assert, that it is an organ of a higher order. Its performances are beyond comprehension. Nature as far as we know never produced anything more wonderful. We can get barely a faint idea of its prodigious power by analyzing what it does and by comparing. When ether waves impinge upon the human body, they produce the sensations of warmth or cold, pleasure or pain, or perhaps other sensations of which we are not aware, and any degree or intensity of these sensations, which degrees are infinite in number, hence an infinite number of distinct sensations. But our sense of touch, or our sense of force, cannot reveal to us these differences in degree or intensity, unless they are very great. Now we can readily conceive how an organism, such as the human in the eternal process of evolution, or more philosophically speaking, adaptation to Nature, being constrained to the use of only the sense of touch or force, for instance, might develop this sense to such a degree of sensitiveness or perfection, that it would be capable of distinguishing the minutest differences in the temperature of a body even at some distance, to a hundredth, or thousanth, or millionth part of a degree. Yet, even this apparently impossible performance would not begin to compare with that of the eye, which is capable of distinguishing and conveying to the mind in a single instant innumerable peculiarities of the body, be it in form or color or other respects. This power of the eye rests upon two things, namely, the rectilinear propagation of the disturbance by which it is affected, and upon its sensitiveness. To say that the eye is sensitive is not saying anything. Compared with it, all other organs are monstrously crude. The organ of smell which guides a dog on the trail of a deer, the organ of touch or force which guides an insect in its wanderings, the organ of hearing which is affected by the slightest disturbances of the air, are sensitive organs, to be sure, but what are they compared with the human eye? No doubt it responds to the faintest echoes or reverberations of the medium; no doubt, it brings us tidings from other worlds, infinitely remote, but in a language we cannot as yet always understand. And why not? Because we live in a medium filled with air and other gases, vapors and a dense mass of solid particles flying about. These play an important part in many phenomena; they fritter away the energy of the vibrations before they can reach the eye; they, too, are the carriers of germs of destruction, they get into our lungs and other organs, clog up the channels and imperceptibly, yet inevitably, arrest the stream of life. Could we but do away with all ponderable matter in the line of sight of the telescope, it would reveal to us undreamt of marvels. Even the unaided eye, I think, would be capable of distinguishing in the pure medium, small objects at distances measured probably by hundreds or perhaps thousands of miles.

But there is something else about the eye which impresses us still more than these wonderful features which we observe, viewing it from the standpoint of a physicist, merely as an optical instrument—something which appeals to us more than its marvelous faculty of being directly affected by the vibrations of the medium, without interference of gross matter, and more than its inconceivable sensitiveness and discerning power. It is its significance in the processes of life. No matter what one's views on Nature and life may be, he must stand amazed when, for the first time in his thoughts, he realizes the importance of the eye in the physical processes and mental performances of the human organism. And how could it be otherwise, when he realizes that the eye is the means through which the human race has acquired the entire knowledge it possesses, that it controls all our motions, more still, all our actions.

There is no way of acquiring knowledge except through the eye. What is the foundation of all philosophical systems of ancient and modern times, in fact, of all the philosophy of man? *I am, I think; I think, therefore I am.* But how could I think and how would I know that I exist, if I had not the eye? For knowledge involves consciousness; consciousness involves ideas, conceptions; conceptions involve pictures or images, and images, the sense of vision, and, therefore, the organ of sight. But how about blind men? will be asked. Yes, a blind man may depict in magnificent poems forms and scenes from real life, from a world he physically does not see. A blind man may touch the keys of an instrument with unerring precision, may build the fastest boat, may discover and invent, calculate and construct, may do still greater wonders, but all the blind men who have done such things have descended from those who had seeing eyes. Nature may reach the same result in many ways. Like a wave in the physical world, in the infinite ocean of the medium which pervades all, so in the world of organisms, in life, an impulse started proceeds onward, at times, may be, with the speed of light; at times, again, so slowly that for ages and ages it seems to stay, passing through processes of a complexity inconceivable to men, but in all its forms, in all its stages, its energy ever and ever integrally present. A single ray of light from a distant star falling upon the eye of a tyrant in bygone times may have altered the course of his life, may have changed the destiny of nations, may have transformed the surface of the globe, so intricate, so unconceivably complex are the processes in Nature. In no way can we get such an overwhelming idea of the grandeur of Nature than when we consider, that in accordance with the law of the conservation of the energy, throughout the Infinite, the forces are in a perfect balance, and hence the energy of a single thought may determine the motion of a Universe. It is not necessary that every individual, not even that every generation or many generations, should have the physical instrument of sight, in order to be able to form images and to think, that is, form ideas or conceptions; but some time or other, during the process of evolution, the eye certainly must have existed, else thought, as we understand it, would be impossible; else conceptions, like spirit, intellect, mind, call it as you may, could not exist. It is conceivable that in some other world, in some other beings, the eye is replaced by a different organ, equally or more perfect, but these beings cannot be men.

Now, what prompts us to all voluntary motions and actions of any kind? Again, the eye. If I am conscious of the motion, I must have an idea or conception, that is, an image, therefore the eye. If I am not precisely conscious of the motion, it is, because the images are vague or indistinct, being blurred by the superimposition of many. But when I perform the motion, does the impulse which prompts me to the action come from within or from without? The greatest physicist have not disdained to endeavor to answer this and similar questions and have at times abandoned themselves to the delights of pure and unrestrained thought. Such questions are generally considered not to belong to the realm of positive physical science, but will before long be annexed to its domain. Helmholtz has probably thought more on life than any modern scientist. Lord Kelvin expressed his belief that life's process is electrical and that there is a force inherent to the organism and determining its motions. Just as much as I am convinced of any physical truth, I am convinced that the motive impulse must come from the outside. For, consider the lowest organism we know—and there are probably many lower ones—an aggregation of a few cells only. If it is capable of voluntary motion it can perform an infinite number of motions, all definite and precise. But now a mechanism consisting of a finite number of parts, and few at that, cannot perform an infinite number of definite motions, hence the impulses which govern its movements must come from the environment. So, the atom, the ulterior element of the Universe's structure, is tossed about in space eternally, a play to external influences, like a float in a troubled sea. Were it to stop its motion it would die. Matter at rest, if such a thing could exist, would be matter dead. Death of matter! Never has a sentence of deeper philosophical meaning been uttered. This is the way in which Prof. Dewar forcibly expresses it in the description of his admirable experiments, in which liquid oxygen is handled as one handles water, and air at ordinary pressure is made to condense and even solidify by the intense cold. Experiments, which serve to illustrate, in his language, the last feeble manifestations of life, the last quiverings of matter about to die. But human eyes shall not witness such a death. There is no death of matter, for throughout the infinite universe, all has to move, to vibrate, that is, to live.

I have made the preceding statements at the peril of treading upon metaphysical ground in my desire to introduce the subject of this lecture in a manner not altogether uninteresting, I may hope, to an audience such as I have the honor to address. But now then, returning to the subject, this divine organ of sight, this indispensable instrument for thought and all intellectual enjoyment, which lays open to us the marvels of this universe, through which we have acquired what knowledge we possess, and which prompts us to, and controls, all our physical and mental activity. By what is it affected? By light! What is light?

We have witnessed the great strides which have been made in all departments of science in recent years. So great have been the advances that we cannot refrain from asking ourselves; Is this all true, or is it but a dream? Centuries ago men have lived, have thought, discovered, invented, and have believed that they were soaring, while they were merely proceeding at a snail's pace. So we too may be mistaken. But taking the truth of the observed events as one of the implied facts of science, we must rejoice in the immense progress already made and still more in the anticipation of what must come, judging from the possibilities opened up by modern research. There is, however, an advance which we have been witnessing, which must be particularly gratifying to every lover of progress. It is not a discovery, or an invention, or an achievement in any particular direction. It is an advance in all directions of scientific thought and experiment. I mean the generalization of the natural forces and phenomena, the looming up of a certain broad idea on the scientific horizon. It is this idea which has, however, long ago taken possession of the most advanced minds, to which I desire to call your attention, and which I intend to illustrate, in a general way, in these experiments, as the first step in answering the question "What is light?" and to realize the modern meaning of this word.

It is beyond the scope of my lecture to dwell upon the subject of light in general, my object being merely to bring presently to your notice a certain class of light effects and a number of phenomena observed in pursuing the study of these effects. But to be consistent in my remarks it is necessary to state that according to that idea, now accepted by the majority of scientific men as a positive result of theoretical and experimental investigation, the various forms or manifestations of energy which were generally designated as "electric," or more precisely "electromagnetic," are energy manifestations of the same nature as those of radiant heat and light. Therefore the phenomena of light and heat, and others besides these, may be called electrical phenomena. Thus, electrical science has become the mother science of all, and its study has become all important. The day when we shall know exactly what "electricity" is will chronicle an event probably greater, more important, than any other recorded in the history of the human race. The time will come when the comfort, the very existence, perhaps, of man will depend upon that wonderful agent. For our existence and comfort we require heat, light and mechanical power. How do we now get all these? We get them from fuel, we get them by consuming material. What will man do when the forests disappear, when the coal fields are exhausted? Only one thing, according to our present knowledge will remain; that is, to transmit power at great distances. Men will go to the waterfalls, to the tides, which are the stores of an infinitesimal part of Nature's immeasurable energy. There will they harness the energy and transmit the same to their settlements, to warm their homes by, to give them light, and to keep their obedient slaves, the machines, toiling. But how will they transmit this energy if not by electricity? Judge then, if the comfort, nay, the very existence, of man will not depend on electricity. I am aware that this view is not that of a practical engineer, but neither is it that of an illusionist, for it is certain that power transmission, which at present is merely a stimulus to enterprise, will some day be a dire necessity.

It is more important for the student, who takes up the study of light phenomena, to make himself thoroughly acquainted with certain modern views, than to peruse entire books on the subject of light itself, as disconnected from these views. Were I therefore to make these demonstrations before students seeking information—and for the sake of the few of those who may be present, give me leave to so assume—it would be my principal endeavor to impress these views upon their minds in this series of experiments.

It might be sufficient for this purpose to perform a simple and well-known experiment. I might take a familiar appliance, a Leyden jar, charge it from a frictional machine, and then discharge it. In explaining to you its permanent state when charged, and its transitory condition when discharging, calling your attention to the forces which enter into play and to the various phenomena they produce, and pointing out the relation of the forces and phenomena, I might fully succeed in illustrating that modern idea. No doubt, to the thinker, this simple experiment would appeal as much as the most magnificent display. But this is to be an experimental demonstration, and one which should possess, besides instructive, also entertaining features, and as such, a simple experiment, such as the one cited, would not go very far towards the attainment of the lecturer's aim. I must, therefore, choose another way of illustrating, more spectacular certainly, but perhaps also more instructive. Instead of the frictional machine and Leyden jar, I shall avail myself in these experiments, of an induction coil of peculiar properties, which was described in detail by me in a lecture before the London Institution of Electrical Engineers, in February, 1892. This induction coil is capable of yielding currents of enormous potential differences, alternating with extreme rapidity. With this apparatus I shall endeavor to show you three distinct classes of effects, or phenomena, and it is my desire that each experiment, while serving for the purpose of illustration, should at the same time teach us some novel truth, or show us some novel aspect of this fascinating science. But before doing this, it seems proper and useful to dwell upon the apparatus employed, and method of obtaining the high potentials and high-frequency currents which are made use of in these experiments.

(To be continued.)

Electric Lighting in Leeds, England.

A central station on the system generally adopted by the various house-to-house electric light companies has just been started at Leeds, England. Actual lighting was commenced at the close of last year with the preliminary plant put down to accommodate consumers pending the starting of the permanent station, which has just taken place. The station is laid out on the Lowrie-Hall system with current in the distributing mains at 2,000 volts, and at 100 volts in the establishments lighted. The plant comprises three boilers of the Lancashire type fitted with mechanical stokers, and constructed for a working pressure of 140 pounds; two Fowler compound horizontal condensing engines of 200 horse-power and one of 100 horse-power, and two alternators of 100 kilowatts and one of 50 kilowatts. The alternators, which are rope driven, are excited by continuous current dynamos arranged on their shafts. The cables are laid underground in cast iron pipes, and transformers are placed at intervals for reducing the 2,000 volt current to 100 volts for lighting. There are three main distributing circuits, and the most distant part lighted is situated about two-and-a-half miles from the generating station. The present capacity of the station is 15,000 incandescent lamps, of which 7,000 are already connected.

The Charges Against Ex-Commissioner Simonds.

A THOROUGH INVESTIGATION IN PROGRESS —PROBABILITY OF A COMPLETE ACQUITTAL.

One of the most decided sensations that has occurred in Patent Office circles for a long time was caused recently by the filing with the Commissioner of Patents of very serious charges against ex-Commissioner William E. Simonds and Messrs. Foster & Freeman, patent attorneys, of Washington, and a request that a rule be issued upon these persons to show cause why they should not be disbarred from further practicing before the Patent Office. These charges were made by Messrs. Church & Church, patent attorneys, of Washington. J. B. Church and Melville Church are the members of the firm making the complaint. The former was, for a number of years, the examiner of interferences in the office, and in that capacity acted on the telephone interference cases. Charles E. Foster has been a very prominent patent attorney for about 30 years and stands at the very head of his profession. His partner, Mr. Frank L. Freeman, was for many years employed in the Patent Office, having served as principal examiner of the electrical division. Mr. Simonds is well known as an ex-member of Congress and ex-commissioner. All of these gentlemen hold positions of the highest standing in their profession as men of ability and integrity. Church & Church are the attorneys for the Drawbaugh Telephone Company, and Foster & Freeman represent the American Bell Telephone Company.

This is said to be the first instance in which one leading firm of patent attorneys has attempted to disbar another firm from practicing before the office. One remarkable feature of the case is the fact that the charges were filed in the patent office and given to the daily papers simultaneously, and this course is believed by many to indicate some purpose other than that shown on the face of the papers. In ordinary cases charges affecting the standing of an attorney are kept secret until after they have been investigated, and the premature publicity of this case has led to much suspicion of ulterior objects on the part of somebody. The fact that it is made in the interest of the notorious Drawbaugh concern, which stands as a most extraordinary combination of able lawyers and wholly unreliable witnesses, does not add to the strength of the case.

The charges, simply stated, are that Foster & Freeman, with the connivance of Commissioner Simonds and Chief Clerk Bennett, who is implicated in the alleged irregularity, procured copies of Drawbaugh applications and other papers which were in the confidential archives of the office, and which the commissioner had no right to give out. The document of especial importance which, it is claimed, was copied, is the original fundamental application of Daniel Drawbaugh, filed July 22, 1880. This application was technically abandoned some time ago, but a number of divisional applications grew out of it, and the far-fetched claim is made that the parent application cannot be considered as dead while any of its children are alive.

Commissioner Seymour set May 24 as the time for a preliminary hearing of the case, and on that day all of the parties interested appeared at his office. Mr. Simonds was represented by ex-Congressman Payson, while Mr. J. J. Storrow appeared for Foster & Freeman. Mr. Church read lengthy charges of a very indefinite character and supplemented them with a pathetic speech in defense of Daniel Drawbaugh, who, he declared, came very near being the most illustrious inventor of the century.

At the close of Church's speech, Mr. Storrow, who always knows more about his antagonist's case than the antagonist himself does, simply and concisely explained the whole case. He said that in his capacity as counsel for the American Bell Telephone Company, he needed copies of certain papers in the Patent Office, to which he had a perfect legal right, that application for them was made in strict accordance with the law and the rules of the office, and that some of them were furnished. One of the papers asked for was a copy of certain documents relating to Drawbaugh's application filed April 3, 1884, and this Commissioner Simonds refused to give, in a decision which was published in the *Official Gazette*, in which he said:

> This Drawbaugh application is regarded as still pending, he having the right to appeal to the Supreme Court of the District of Columbia from the Commissioner's decision. Therefore, to grant either of the requests of the petition is to go counter to the settled practice of the Office, and it is thought that the Office rule, which requires applications for patents to be kept confidential, is both sound and discreet. But this rule ought not to be carried so far as to defeat the ends of justice by keeping out of a party defendant's reach evidence essential to the proving of his case.
>
> "It is thought that when a court of competent jurisdiction, having a case before it, advises the Office that certain evidence of this sort within the possession of the Office is essential to the proper decision of the case, the Commissioner will then be justified in furnishing it.
>
> "On the present showing the petition is denied."

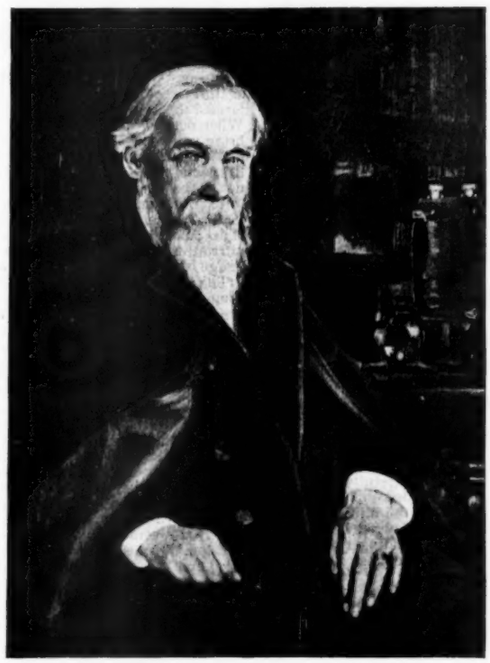
This decision shows extreme caution on the part of Mr. Simonds, who is one of the best informed patent lawyers in the country. In fact, the rules of the Patent Office and the decisions of Mr. Simonds, as well as of some of his predecessors, have generally been more strict than various decisions of the courts seem to render absolutely necessary. On January 5, 1891, Judge Lacombe, of New York, in the case of the Edison Electric Light Company *vs.* the United States Electric Lighting Company, gave a very radical opinion bearing on this point. In this case the Patent Office was not a party to the suit, and there does not appear to have been any necessity for Lacombe to have given his construction of Section 4902 of the Revised Statutes, which alludes to the subject. He took occasion, however, to say that "Congress expressly provided that all applications interfering with caveats should be deposited in the confidential archives and be therefore private. If *all* applications were thus private this provision would have been unnecessary, and the fact of its enactment seems to indicate quite clearly that Congress, having the whole subject under advisement, determined that it would extend the privilege to the particular class of applications therein specified and, inferentially, only to them."

Another case bearing on the question was decided in the Supreme Court of the District of Columbia, November 12, 1888, in which the court took the extreme grounds that "an application once made and filed in the Patent Office belongs to the whole public," and the decision in that case was "that an applicant for copies of papers is entitled to a writ of mandamus against the commissioner to compel a compliance with his request." This decision would not, however, give an applicant the right to get such copies without first securing a writ of mandamus from a competent court, and this is the position Mr. Simonds took in dealing with the application of the Bell Telephone Company.

The preliminary inquiry before Commissioner Seymour developed the fact that, while Mr. Simonds was considering that application, with much deliberation and caution, he directed the custodians of the records to have the copies of the papers made in order to save delay should he decide to give them to the Bell Company, with most positive instructions not to allow them to go out of his possession until the case should be settled. When he decided to refuse the application, the duplicate copies were locked up in the safe of the Assistant Commissioner, and they have been kept there ever since. By some means Church & Church ascertained that these copies were in the office; and apparently jumped to the conclusion that somebody might have procured a triplicate copy. That seemed to be the whole ground of the sensational newspaper charges. The answers to the charges filed by each one of the persons complained of are consistent and straight to the point, and clearly show that their action in the matter was free from any suspicion of misconduct. They are all pressing for immediate and thorough investigation.

Commissioner Seymour does not find the task of investigating his predecessor very agreeable, and has proposed to appoint a referee to take the testimony and report his findings. There is some question as to his right to take this course, and the question has been submitted to the attorney general. It is expected that the examination will go on early this week. The whole case is being dissected and discussed by patent attorneys and others in Washington. The drift of opinion is that the charges cannot be substantiated, and Church & Church are quite generally criticised for making public such a scandal.

G. C. M.



PROFESSOR MOSES GERRISH FARMER.

The American Telephone and Telegraph Company has declared its first quarterly dividend of 1¼ per cent.

Death of Professor Moses G. Farmer.

Another pioneer has dropped from the ranks. At the age of 73 years, Prof. Moses Gerrish Farmer gave up his life of usefulness and has left behind him a name to be classed among the first in the field of electricity. He died in Chicago last week, having disregarded the advice of his physicians, who had cautioned him that a visit to that city might greatly endanger his life.

Born in Boscawen, N. H., on February 9, 1820, he received an ordinary school education at Andover, Mass., and later entered and was graduated from Dartmouth College. Until 1847 he taught school and then turned his attention to electricity and its applications. In this year he had business dealings with a contractor for telephone lines in Framingham, Mass. Here it was that he invented his now well known fire alarm apparatus controlled by electricity. Numerous appropriations by the city of Boston enabled him to carry on successfully his experiments, and later, when he had completed his system, he was appointed superintendent of the Boston fire alarm system.

After embarking in several non-electrical enterprises, in 1872 he was appointed to the office of electrician at the United States Naval Torpedo Station at Newport, R. I. In this position he continued until 1881, when his health, which had never been of the best, gave way, and he was compelled to retire to his home in Eliot, Me., where the remains will now be interred.

His electro-magnetic engine and railroad has become a historical and almost foundation stone in the electrical structure of this day, he having, in 1847, constructed and exhibited in working order at Dover, N. H., a complete motor car of his own invention run by 48 cells of Grove batteries. He was celebrated for his note books, and while electrician for the United States Company he was looked upon by his friendly coworkers as an inventor, unfortunately like many others, who realized but too late that it required practical application to show the true value of an invention. His most voluminous record of his achievements will now be cherished by those who will feel that they are the works of one who invented not wisely, but too well.

Transforming Direct to Alternating Currents.

Since the introduction of triphase currents, the transformation of continuous currents into triphase, two-phase, or ordinary alternating currents has been effected with facility.

Mr. F. Lucas, according to *La Lumière Electrique* has recently devised a method of transforming a continuous current from any source whatsoever into either simple alternating currents or multiphase currents with any desired frequency.

The apparatus consists of two copper or silicon bronze rings, each having an odd number of equally spaced radial arms. These two rings are mounted on the same spindle, and separated from one another by a disc of insulating material, and so fixed that the arms on one side coincide with the spaces on the other. Connections are made in the following manner: The poles of the continuous current source are connected to brushes making contact with the two rings. The ends of the circuit destined to carry the alternating current are connected to two brushes, each wide enough to make contact on either set of arms alternately, and placed diametrically opposite to one another. It will be seen that neither brush can make contact on both sides simultaneously, since the arms on one side coincide with gaps on the other. It will also be evident that when the top brush is bearing on one side the bottom brush will be bearing on the other side, as each set is made up of an odd number of arms. If the spindle be rotated, an alternating current will be produced, since the brushes alternately make contact on arms of different sign.

If n = the number of each set of radial arms, then the number of reversals per revolution $= 2n$. If ω be the angular velocity of the arms, then the duration of each period $= \frac{\omega}{n}$, and is therefore proportional to angular velocity, and inversely proportional to the number of arms. There is, however, a period of short-circuit at every reversal, and in order to make this period as short as possible Mr. Lucas found it necessary to give the brushes a gentle rocking motion. By suitably arranging the brushes it is possible to obtain diphase and triphase currents.

A MODIFIED DEPREZ—D'ARSONVAL GALVANOMETER.

READ AT THE TENTH GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MAY 17, 1893, BY LIEUT. CHARLES D. PARKHURST.

So far as the writer has observed in all forms of this galvanometer in actual use, or as illustrated and described in various articles descriptive of its construction and use, and in catalogues advertising it for sale, it has always been arranged for use with a lamp stand and scale for reading the deflections by the varying position of the spot of light and image of cross-hair reflected from a concave mirror; the protective screen to cut off air currents has always been of glass, and even though a plain mirror be substituted for the concave, there is nothing to put the mirror in shadow; hence, as the writer knows from experience, no satisfactory results could be obtained with this form used in connection with a reading telescope.

Opinions may differ as to the relative merits of the two systems of reading reflecting galvanometer deflections. Certain it is, however, that the lamp stand and scale, form a clumsy and bulky outfit. To get a good, sharp and clear image of the spot of light and its cross-hair needs a very strong light or a dark closet in which to use the galvanometer. Independent of its bulkiness and want of portability, it is a hot and inconvenient method of reading, and one that, in the writer's opinion, bears no comparison with the ease and refinements of reading obtainable with a reading telescope worthy of the name.

Since to show up well in a reading telescope the mirror must be in a heavy shadow, and the scale upon the telescope be well illuminated, the writer found that a modification of the ordinary D'Arsonval galvanometer in his possession was necessary, and this modification will now be described, reference being made to the drawing herewith.

The horseshoe or rather U-shaped magnet was dropped down completely through the base, so as to project below its lower

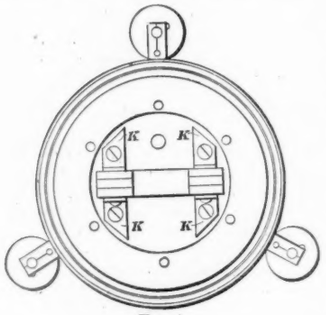


FIG. 1.

surface sufficiently to allow the lower tension spring to be mounted on the under side of the base, where it could be reached at any time to adjust the tension of the suspension. This became necessary owing to the fixed brass case which enclosed the instrument, as shown in the illustration, this fixed brass case being the necessary opaque case to shut off all light except from the front, and at the same time protect the interior of the instrument from all air currents. The leveling screws of the base were made long enough to allow the tension spring screws to be conveniently reached without disturbing the galvanometer when once set up and leveled. All adjustments necessary at any time could therefore be made without any undue disturbance of the galvanometer on its stand. This tension spring is shown at S, Figs. 2 and 3; the check nut and tension screw at C and T, same figures.

Although the construction of the ordinary D'Arsonval galvanometer is probably known to all, the following complete description is given of the modified construction for the benefit of any who may not be familiar with the instrument in any form, and also to enable the modification to be fully understood and be copied by any one desirous of so doing. Fig. 1 shows the plan of the base with the magnet in position; double brass knees are used to ensure the vertical and rigid position of the magnet. (See K K, Figs. 1, 2 and 3.) In Figs. 2 and 3 it will be seen how the magnet is dropped down through the base, giving room between the bottom of the base and the bend of the magnet for the point of the tension spring to extend into the center line, so as to receive the lower suspension wire. The spring itself is a flat strip of spring sheet brass about $\frac{1}{16}$ inch thick, $\frac{1}{2}$ inch wide at the securing end, and $\frac{1}{8}$ inch wide at the free end. It is mounted upon a block of brass $\frac{1}{2} \times \frac{3}{4} \times \frac{1}{8}$ at the securing end, and here rigidly secured to the base; this gives plenty of free play for the spring at its free end and it carries a small silver hook securely soldered into the spring.

The base itself is turned up from the solid ebonite, with a raised central part that fits the bottom of the brass snugly, thereby centering the latter upon the base; the brass case is of four inch brass tubing, $\frac{1}{16}$ inch thick, provided with the window as shown. The window is made large to allow the mirror and its reflected scale to be seen through a wide angle.

The frame of the instrument to provide suspensions for the coil is entirely independent of the case. It consists of the upright brass bar U and the upper bar T. The upright is securely fastened to the base in rear of the center of the magnet as shown, and at right angles to the base.

The bar T projects over the top of the magnet, as shown, and carries upon it, as an integral part, the circular flanged plate P. This plate fits into a corresponding central hole in the top of the brass case, so as to close this latter hole snugly; this hole is necessary so that the case can be removed at any time without disturbing the suspension, or can be put on after any adjustment or repairs that require the removal of the case, and yet leave the suspension untouched.

In the center of the plate P, and so as to be exactly over the center of the magnet, the tube R is securely fastened; this tube carries and centers the sliding rod A; this latter rod carries at its lower end the silver hook as shown, and is clamped in any position desired by the screw W and check nut N.

The coil frame F is made from thin sheet copper worked over a form into a light rectangular frame with flanged edges to form a groove into which the wire is wound. The thinnest kind of thin copper is used. It forms a thin, light and yet rigid frame, the flanged sides greatly stiffening it. Such a frame may be made from silver, or from aluminium, with probably as good results. This frame is wound full of No. 40 double silk covered copper magnet wire, and has, in this instance, a resistance of 275 ohms. Other windings can, of course, be used, depending upon the use for which the instrument is intended.

The supports for this coil frame are two small silver hooks, the upper one long enough to form a support for the mirror M. To the end of each of these hooks a light plate of copper is fastened and by these plates the hooks are secured to the frame, by a winding of waxed silk; a thin plate of mica insulates the plates from the windings of the coil. After the hooks are accurately adjusted so as to coincide with the true axes of the frame, and firmly secured, the ends of the coil wire are made fast, one end to each hook, so that the hooks form the true terminals of the coil.

The mirror is supported in a very light ring of brass. This ring has a shoulder within it that holds the mirror from falling out at the front, while a piece of very light thin tubing is soldered carefully across the back, in fine notches filed out of the ring to receive it, and holds the mirror securely. The wire of the upper hook fits this tubing friction tight; before binding the wire to the hook form the mounted mirror is slipped upon it by its tube, and the hook is then formed. The friction of the tube on the wire holds the mirror frame securely and yet allows it to be adjusted, if necessary, to any required angle, with or in the true plane of the coil frame.

This mounting was adopted after many others had been tested and rejected. Cementing the mirror upon the wire is a clumsy method that may result in the ruin of the mirror by pulling off the amalgam or by distortion due to the strains set up by the drying cement. These mirrors are so thin and flexible, and distortion is so easily done, that care must be exercised in keeping them free from strain, so as to preserve a plane mirror and a true image. This mounting is light and yet rigid, and holds the mirror perfectly true, with no distortion; the bright brass is made black with platinum chloride, so as to prevent any false image or glitter from the frame. This mounting also brings the mirror close in against the suspension, so that its deflection affords a very close approximation to the true deflection of the coil. By strict principles the axis of the suspension should pass through the mirror, and a suspension frame for the mirror can be and has been made to secure this. But in this particular case, since the current has to flow through the suspension, the simpler and more direct the flow the better, and the error introduced is so insignificant that it can be neglected.

The cylinder D is of soft iron, and the softer and purer it is the better. It is permanently secured to the upright U by the small brass arm shown in Fig. 3. It should be solid and not a tube, as in a good many instruments, as it thus has much greater permeance, more lines of force are drawn in, and the field of force between it and the limbs of the magnet becomes greatly strengthened. Since it is in this field of force that the coil is to turn, it naturally follows that it should be made as intense as possible.

As shown in Fig. 2, the coil frame is suspended between the top hook at T and the bottom hook upon the tension spring S. It should swing freely in the space between the magnet poles and the cylinder D, without rubbing or striking. The leveling screws are provided to permit of proper adjustment to secure this free swing, as the suspension wire is so light that it has not enough rigidity to hold the frame true if the instrument is out of level, and the frame will

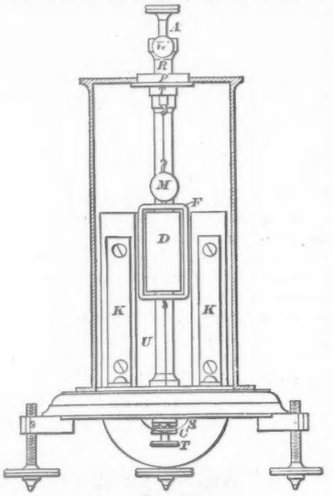


FIG. 2.

then sag to one side and strike or rub against the cylinder or magnet. If properly leveled the frame has a clear, free swing. When deflected far enough it will, of course, bring up on the support of the cylinder D; but this cannot be avoided, and such a deflection is away beyond the usual and proper use of the instrument.

The interior of the case is made a dead black, the same as the interior of telescope tubes; no light is reflected except by the mirror, and a clear, sharp, well-defined image of the scale is the consequent result.

The wire used for the suspension is of the utmost importance; upon this depends in a great measure the "dead beat" qualities of the instrument. For such a coil as that described, wire as fine as .003 in. was used, and a true "dead beat" galvanometer was the result. This wire is strong enough to hold the mirror and frame under proper tension, so that the torsion of the wire will bring and hold the mirror at zero, and yet it is so light that the feeblest kind of a current will produce an appreciable deflection. For coils of other windings heavier wire may possibly be used, but as the writer wanted a very delicate and yet "dead beat" instrument, it was made as described, and after several sizes of wire for the suspension, down as fine even as No. 32, were tried and did not give good "dead beat"

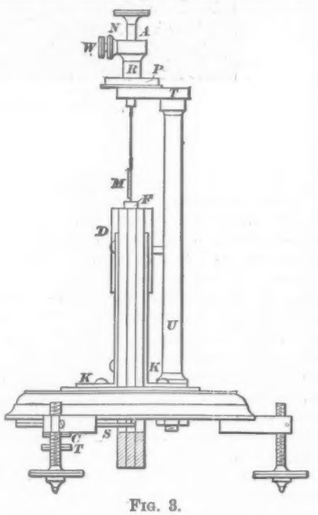


FIG. 3.

results, the finest wire ordinarily obtainable, *i. e.*, .003 in. diameter, was tried and all the troubles vanished. Now the mirror swings smoothly and truly up to its deflection and stops without a quiver, and, when a short-circuiting key is used to break the current from the battery or other source, it swings back to zero and stops there dead, without quiver or oscillation.

The circuit through the instrument is from one binding post through a heavy wire to the foot of the upright U; thence through this to the upper hook and suspension wire to the coil, through the coil to the lower suspension wire to hook and tension spring, and thence by another wire to the other binding post. The foot of the upright and the tension spring are therefore the true terminals of the instrument, and should be insulated from each other perfectly. The binding posts can be anywhere convenient, so long as they are also insulated from each other

It should be plain that in this instrument we have the ordinary galvanometer reversed. The needle is replaced by the powerful fixed magnet, while the coil is movable. Since the field of force of the magnet is so strong as to be practically independent of the earth's field of force, we can use the galvanometer in any position independent of the magnetic meridian. For its most delicate use, however, it should be set up so that the plane of the magnet lies in the magnetic meridian with the poles in proper relation to the North and South; the earth's field of force then reinforces that of the magnet, and adds to the power of the instrument.

Since this is an instrument by itself, none of the known laws will probably apply except the general law that for small deflections the current strengths may be taken to be proportional to the angles of deflection. We can determine its "constant" or deflecting current necessary to produce a deflection of one scale division, and then use this constant even afterwards (for the same distance of the scale from the mirror) to determine the strengths of other currents producing other deflections.

For laboratory work the galvanometer and telescope would probably be permanently set up, with some convenient fixed distance between them; the constant once determined becomes then the true constant forever afterwards.

When used as a portable instrument, however, the distance from mirror to scale may not always be kept the same. In this case the constant must be determined for each position of the telescope and scale; but this is very simply done, and need cause no great delay or trouble.

As a specimen of the delicacy of the instrument as used with a reading telescope, the writer has frequently seen a deflection, when balancing resistances by the Wheatstone bridge method, that did not uncover the cross-hair of the eye-piece completely from the zero line of the scale; the cross-hair is a fine spider web, so fine that it can hardly be seen with the naked eye, and the lines upon the scale are as fine as they can be printed from an engraved plate, yet they did not completely separate from true coincidence; the slight movement of the scale was perceptible, but, of course, could not be measured. This movement yet indicated that a true balance had not yet been obtained, for finally it would disappear and the mirror hang dead still upon further adjustment of the resistances. This shows how sensitive the instrument is, and how closely we can see the slightest suspicion of deflection when using a reading telescope. Resistances adjusted down to absolute zero of the mirror's movement may be taken as pretty closely measured, much closer than is possible with any ordinary galvanometer, and, as the writer believes, much closer than can possibly be done with lamp stand and scale, even with the best of dark closets.

The one great objection to this galvanometer is its want of ready portability; admirably adapted as it is for all kinds of measurements with the utmost delicacy, even in the dynamo room, in proximity to dynamos in action, it yet is not readily transported and set up, owing to the delicacy of the suspension; it will stand a considerable handling without injury, but yet there is much to be desired to render it absolutely portable and free from any liability to injury in transportation, and quickly available without any tedious adjustment being necessary when set up wherever required.

The Weston voltmeter and ammeter is such an adaptation, these instruments being the simple D'Arsonval galvanometer in another form, and specially constructed and graded for special work; though they are most admirable and accurate, and can be used for all kinds of measurements, they yet leave something to be desired, in that they read by index and not by mirror, and hence extreme refinement of reading becomes impossible. With a view to meet this requirement the following described instrument has been devised and is now in process of construction:

The magnet is made circular and compound with soft iron pole pieces, similar to the arrangement in the Pitkin form of D'Arsonval instrument; but in place of the wire suspension of that instrument the steel pinion and pivoted centers of the Weston form, with the double hair springs, are adopted.

The coil may be the flat coil of the Pitkin instrument, or it may be the rectangular coil as generally used. If the flat coil is used the mirror can be attached to the coil; with the rectangular coil the mirror frame is set within the rectangle as shown; in both cases, of course, the mirror turns with the coil. A window, as shown, is provided in

the case to allow the movements of the mirror to be observed. This window can have a brass cap or cover to slip on to protect the glass in transportation.

The bottom and top of the case are of hard rubber; the side of the case is thin brass tubing; in the case, in the space within the bend of the magnet, a set of shunt coils may be inserted with terminal blocks on the top of the case; the binding posts are upon the top and a short circuit may be provided as shown.

Where the rectangular coil is used an iron core can be still put in inside the frame of the coil, being cut away as shown to allow the mirror to have room to swing. This really makes this iron core in two pieces, yet it contains a large mass of iron and helps to strengthen the field of force in which the coil swings; the field of force is kept symmetrical by the shape given to the pole pieces, so that the lines of force are evenly distributed from front to rear, and the coil remains in practically a constant field during its entire swing. The cutting away of the poles each side of the mirror is to allow the scale to be still reflected from the mirror after large deflection.

We then have a neat, compact and readily portable instrument, whose readings should be as fine and delicate as one may desire. Since the beam of light weighs nothing and can be made almost as long as one chooses, within reasonable limits, it should be evident how greatly the scale is magnified and how fine and close the readings may be. The writer may, perhaps, be pardoned if he illustrates this point a little more fully.

Galvanometers with indices must have a very finely graduated scale to read closer than one-fourth of a degree; the average will not read closer than one-half degree; fine readings are, therefore, impossible as a certainty, particularly when the tremble and quiver of a finely poised needle and index are considered. The Weston instruments are of this class, and, although they can be closely read by estimation, we are not certain of the reading, though, perhaps, we can read close enough for the general work for which they are used.

With a mirror, scale and fine reading telescope we have an index that is imponderable, and about as long as we choose within reasonable limits. The scale being graduated to millimetres, is easily read at a distance of 3,000 scale divisions, a little over 10 feet; the writer has frequently used a telescope at a distance of 12 feet, the distance being only limited by the size of the room, and not by any difficulties in reading the scale.

At this distance, then, a deflection of one millimetre, easily accurately read, means a tangent of $\frac{1}{3000}$ or .000333, corresponding to an angle of about one minute of arc, and, as this is the tangent of twice the actual angle of displacement of the mirror, we see that the mirror has actually moved about one-half minute only.

We can read this small angle positively; by estimation we can read one-half of a scale division, or our scale can be graduated to half millimetres, and we can read that deflection positively; hence we see that we can read down much finer, and with more positive exactness, than can be done by any other method, a movement of the mirror being visible in the telescope that could hardly be detected with the unaided eye, and that would be imperceptible if an index had been used.

In conclusion, the writer would say that he hopes the modifications of the instrument as described may be found of value and use. So far as he knows they are original, and are not protected by any patents; any one should be, therefore, free to construct and use such instruments, and if any one so does, and gets as much satisfaction from their use as has been his good fortune, the writer will be fully satisfied.

While upon the subject of measuring instruments, though not exactly pertinent to the instrument described, the writer would beg leave to invite attention to some action being necessary to try to induce instrument makers to be more complete in the data that is furnished with their instruments, which data can only be accurately determined by the maker during process of manufacture, and which, if not then made of permanent record, forever after can only be arrived at approximately by experiment. Such data, carefully and permanently recorded, would oftentimes enhance the value of the instrument more than the extra cost from the extra trouble could possibly amount to.

Reference is here made to the various makers of tangent galvanometers as requiring such attention to the data of its construction, etc., as shown by the following:

The writer has seen more than one fine standard tangent galvanometer of the Western Union pattern about which there was no information or data to be had as to the number of turns of wire in each coil, or their mean radii. Similarly, Helmholtz-Gaugain galvanometers have been seen and used by him that were lacking in this same important data. These instruments were all high grade, costing from $125 to $175 each, and yet, for want of a data that could have been recorded permanently by the maker at but slight additional expense, that could only be used positively and absolutely for the relative strengths of currents, except by calibrating them absolutely by reference to some other instruments that had an absolute calibration.

The writer well remembers a long, tedious and delicate series of experiments he was called upon to perform, to try to work backwards, and, from the absolute strengths as shown by a copper voltameter, to determine the turns of wire upon a coil, so that the instrument could afterwards be used in accordance with the formulæ for its use in measuring the absolute strength of currents. Necessarily the experiments were unsatisfactory, and, after its determination, the number of turns as deduced was unreliable.

The formulæ for the use of tangent galvanometers in this manner contain the following quantities as necessary to know:

n = number of turns of wire in coil or coils in use.

r = mean radius in centimetres of the coil or coils in use.

d = distance of centre of coil from centre of needle in centimetres (for use in sliding coil tangent instruments, such as the Edelman and others).

h = horizontal component of the earth's magnetism at the place of observation (to be determined by experiment and does not necessarily become data for any particular instrument except for a fixed locality).

It will be seen that the resistance of the coils or of the instrument is not required. Yet we find resistance carefully measured and recorded and much more important data completely omitted.

On foreign, and particularly German instruments, we generally find all this data given, and centimetre scales properly arranged to measure D when the coil is moved away from the needle to any position. But I have yet to see any uniformity in this respect with American made instruments, hence my comments as above.

We all know that if we know certain quantities, very hard to know or to keep constant, we can find the strength of current giving any deflection by the application of Ohm's law. But though we may know the exact external resistance in circuit by careful measurements, do we know for a dead certainty what the battery or other generator's internal resistance may be from time to time as we use it? Can we be positively sure of the electromotive force of our source of current? Until we can be certain of these two changeable and ever changing quantities we cannot be certain of the current strengths as given by Ohm's law; hence the great desirability for use of the general formulæ, into which electromotive force and battery or other resistance does not enter, and the great need for the furnishing of the proper data by instrument makers to enable us to use these formulæ.

Cutter's Voltmeter Switch.

The need of maintaining a uniform pressure at the lamps is being more generally appreciated every year and will undoubtedly lead to greater economy in incandescent lighting. The voltmeters reading anywhere within 10 or 12 per cent. of the mark, which were so common a few years ago, are being replaced by more accurate ones, and there is a marked tendency towards keeping the voltage steadily at the fixed standard. In order to do this with quite a number of circuits, an equally large number of voltmeters have been commonly used, and these have almost always been cheap and inaccurate instruments. By far the better plan consists in using a single but first-class voltmeter for every eight or ten circuits and having a special device for readily connecting the instrument to any of these circuits. The switch illustrated herewith was designed for this purpose, and is found to be admirably well suited to the work. It is built in sizes ranging from six to 16 points, and being made entirely of brass, copper and hard rubber will look well on any switchboard. The maker is George Cutter, of Chicago.

Electric Heating Patents Sold.

The Standard Electric Heating Company, of Boston, which controlled the O'Neill electro-thermal heating patents, and which equipped and heated a West End car by its system last winter, has sold out to the American Electric Heating Company. The latter company controls most of the devices for producing heat by electricity, and manufactures numerous implements for electric heating and cooking.

WORLD'S FAIR NEWS.

The Eureka Tempered Copper Company, of North East, Pa., have an exceedingly artistic booth situated in the southwest gallery of Electricity Building, which contains their exhibit, consisting of tempered copper castings for electrical purposes, etc. Since the development of the electrical science the use of copper in the construction of the vital parts of all electrical apparatus, and especially that of the dynamo electric machinery, is very great, on account of the conductive properties contained in this metal, which is greater than any other cast metal, thereby making it indispensable for first class electrical work. They have a fine display of copper railway gear, trolley wheel, brushes, commutator segments, and also commutators in all sizes from one-sixth horse-power to those used in the Westinghouse 10,000 light generators. This company is giving away a souvenir medal made of copper about the size of a silver dollar, on one side of which is stamped showing castings which they make for electrical purposes, while the other contains a *fac-simile* of the John Scott medal awarded them at Philadelphia in 1891.

The Mackay-Bennett Cable Company has added some old relics in the shape of several pieces of cable to their exhibit which were fished up from the sea from time to time. They display a section of cable five inches in

CUTTER'S VOLTMETER SWITCH.

circumference which was crushed by ice in Dover Bay, N. S., March 23, 1887, flattening the same to about the thickness of ordinary paper, thereby breaking the connection. They also exhibit a piece of Brockport cable which was hooked by a fishing schooner off Gloucester, Mass., November 25, 1888, and a piece of Coney Island cable five inches in diameter which was completely worn away by constant chafing on the rocks. This break occurred January 13, 1891, and was restored January 27 of the same year. They also have a very neat model of their repairing steamer, Mackay Bennett, together with the mallet used in launching the boat; also a grapnel used by the ship for hooking the cable. They also show a piece of the first cable laid across the Atlantic in 1858. This company is giving away souvenir cablegrams to parties visiting at their booth, showing the manner in which the messages are sent and received.

The Western Electric Company are installing a very large and fine exhibit in the southwest corner of Electricity Building, which will surely attract the attention of the visitors during the Fair. Their pavilion consists of a temple designed to represent an old Egyptian temple, which is decorated on the outside with Egyptian figures representing the performance of the operations seen in the Western Electric factories. The inside of the building is constructed in the main of stained glass, behind which are placed incandescent lights, making the effect most novel. Another novel feature of their exhibit is a large column of light, consisting of over 3,000 incandescent lamps wound spirally around the column and branching out upon streamers representing lightning, and at the end of the streamers is a large ball which revolves at a high rate of speed when the light which travels slowly from the column reaches it, showing colors of red, white and blue at different intervals. This effect is automatically produced by means of a large rotating switch. The current used in this decoration is 110 volts, while in the temple 220 is used. The manner of reducing the current for the light effect on the column is accomplished by means of a motor generator consisting of two machines mounted on the same base and coupled shaft to shaft.

The Central Telephone Exchange was last week transferred from the Service Building to the large, handsome pavilion of the American Bell Telephone Company in Electricity Building. The switchboard which is now in use is something entirely new and is known as the branch terminal multiple. It is claimed to have many technical advantages over the old, but the greatest is the protection it affords from dust. The board has operating capacity of 1,000 machines and affords a place for 16 operators. The pavilion of this company is without exception the finest in the building. The ceiling is beautifully decorated and studded with incandescent lamps, giving it a very pretty effect when lighted. They have on exhibition parts of the telephone from the first invented to those used at the present time, among which are the essential parts of the first electrical telephone that ever transmitted speech, which was constructed by Thos. A. Watson according to instructions given him by Alexander Graham Bell in the year 1875, and at which time Mr. Bell uttered the first words ever spoken in the telephone. These parts are enclosed in large show cases, which are constantly guarded, and attract the attention of all visitors entering their pavilion, which is most liberally patronized. The following figures, giving the number of miles of wire used, number of exchanges, connections, etc., made each year since the use of the telephones to the present time, will no doubt be interesting to our readers:

Miles of wire in use underground for telephonic purposes in the United States on January 1 of each year: 1885, 1,225; 1886, 3,417; 1887, 6,030; 1888, 8,149; 1889, 17,365; 1890, 27,676; 1891, 55,823; 1892, 71,506; 1893, 91,463.

Miles of wire in use for telephonic purposes in the United States on January 1 of each year: 1881, 29,714; 1882, 52,205; 1883, 82,224; 1884, 115,255; 1885, 137,223; 1886, 155,791; 1887, 171,998; 1888, 202,617; 1889, 243,764; 1890, 279,941; 1891, 331,642; 1892, 381,544; 1893, 440,793.

Number of telephones in use in the United States on December 20 of each year: 1877, 5,187; 1878, 17,567; 1879, 52,517; 1880, 123,380; 1881, 180,592; 1882, 237,728; 1883, 298,580; 1884, 325,574; 1885, 330,040; 1886, 353,518; 1887, 380,277; 1888, 411,511; 1889, 444,861; 1890, 483,790; 1891, 512,407; 1892, 552,720.

Number of connections between exchange subscribers in the United States in each year, yearly rate based upon daily use: 1884, 215,280,000; 1885, 251,267,760; 1886, 272,478,705; 1887, 312,605,710; 1888, 369,203,705; 1889, 383,821,590; 1890, 400,000,000; 1891, 450,000,000; 1892, 500,000,000; 1893, 600,000,000.

Number of subscribers in the United States for telephones on January 1 of each year: 1881, 47,880; 1882, 70,525; 1883, 97,728; 1884, 123,625; 1885, 134,847; 1886, 137,750; 1887, 147,068; 1888, 159,712; 1889, 171,454; 1890, 185,003; 1891, 201,931; 1892, 216,017; 1893, 232,140.

Number of telephone exchanges in the United States on January 1 of each year: 1880, 138; 1881, 408; 1882, 486; 1883, 1,070; 1884, 1,325; 1885, 1,253; 1886, 1,175; 1887, 1,182; 1888, 1,191; 1889, 1,194; 1890, 1,228; 1891, 1,241; 1892, 1,297; 1893, 1,351.

Persons employed in telephone exchanges of the United States January 1 of each year: 1881, 1,481; 1882, 1,863; 1883, 3,716; 1884, 4,762; 1885, 5,168; 1886, 5,438; 1887, 5,843; 1888, 6,183; 1889, 6,310; 1890, 6,758; 1891, 7,845; 1892, 8,376; 1893, 9,970.

Chicago, May 27, 1893. M. J. B.

The New York Board of Electrical Control last week cut down 175,000 feet of wire belonging to the Automatic Burglar Alarm Company in Harlem. This company has nearly a million feet of wire strung on the housetops in Harlem which it has been ordered to remove.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3829. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1646 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

NEW YORK, JUNE 3, 1893.

CONTENTS.

	PAGE
Views, News and Interviews	189
"Kerite" at the World's Fair	189
On Light and Other High Frequency Phenomena	189
Electric Lighting in Leeds, England	190
The Charges Against Ex-Commissioner Simonds	191
Death of Professor Moses G. Farmer	191
Transforming Direct to Alternating Currents	191
A Modified Deprez-D'Arsonval Galvanometer	192
Cutter's Voltmeter Switch	193
Electric Heating Patents Sold	193
World's Fair News	193
Electricity in Medicine	194
Electricity in Agriculture	194
Dangerous (?) Trolley Cars	194
Letters from a Laboratory	194
Correspondence:	
Our Boston Letter	195
Our Chicago Letter	195
Electricity Sued for Libel	195
The Lady Electricians' Union Meets Again	195
A Necessary Modification of Ohm's Law	195
Bombe & Suchhard's Combined Arc Lamp and Incandescent Lamp System	196
Preliminary Programme of the International Electrical Congress	196
The General Electric Company's New Street Railway Motor	197
Electric Railway and Power Notes	197
Wall Street and the Electrical Stock Market	198
New La Roche Direct Current Dynamo	198
General Notes	198
Advance Information	199
Electric Light Flashes	199
Experiments with High Frequency Discharges	199
Kindred Interests	200
The Elektron Manufacturing Company	200
Increasing Towing Power	200
Electrical Patents	x
Telephone Chat	x
Literary	x
The Armored Cruiser "New York's" Electric Gig	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
American Electrical Works, insulated wire	i
Ansonia Brass & Copper Co., wire	xvi
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi
Beatey, Geo. A., engines	i
Campbell Electrical Supply Co., insulating tape	i
Claflin & Kimball, incandescent lamps	i & ii
Crocker-Wheeler Motor Co., motors	i
Day's Kerite, insulated wire	i
Dwight Slate Machine Co	xvi
Eastern Electric Cable Co., insulated wire	xvi
Eddy Electric Mfg. Co., motors	i
Empire China Works, porcelain specialties	xvi
Faraday Carbon Co., carbons	xvi
General Electric Co., transformers	xv
Hampson & Co., E. P., engines	xvi
Lake & Co., J. H. & D., pulleys	i
Massachusetts Chemical Co., insullac	i
Mather Electric Co., Novak	i & ii
Moore, Alfred F., wire	xvi
Okonite Co., insulated wire	i & xvi
Otis Bros. & Co., elevators	xvi
Paine & Ladd, patent attorneys	i
Rhode Island Tool Co., drop forging, etc	xvi
Rikor Electric Motor Co., motors, dynamos	i
Simplex Electrical Co., insulated wire	i
Waterhouse, Gamble & Co., arc lamps	i
Weston Engine Co., engines	i
Wilmot & Hobbs Mfg. Co., bell gongs	xvi

INSIDE PAGES.

	PAGE
Alexander, Barney & Chapin, electric fan outfits	v
Allis & Co., Edward P., engines	v
American Bell Telephone Co	xiv
American Fluoride Co., fluoride	xi
Baker & Co., platinum	x
Barrett, John A., electrical engineer	x
Berlin Iron Bridge Co., iron roofs and buildings	xi
Bishop Gutta Percha Co., insulated wire	xi
Blaisdell & Co., tools	ix
Brill Co., J. G., tramway cars	xii
Brizey, W. B., Kerite wires and cables	viii
Brown Electric Co., portable crane	x
Brush Electric Co., apparatus	iv
Bryant Electric Co., switches and sockets	viii
Buckeye Engine Co., engines	xi
Carpenter Enamel Rheostat Co., rheostats	ix
Case Engine Co., J. T., steam engines	viii
Central Electric Co., supplies	xiv
Clark Electric Co., arc lighting	xiv
Columbia Incandescent Lamp Co., incandescent lamps	v
Cutter, George, electrical supplies	viii
Dixon Crucible Co., belt dressing	ix
Edison Decorative and Miniature Lamp Department, incandescent lamps	200
Electric Selector and Signal Co.	xiv
Electrical Specialty Co., switches	xii
Electrical and Mechanical Engineering and Trading Co., contractors	xiv
Electro-Light Engraving Co., engraving	vi
Falls Rivet & Machine Co., friction clutches	v
Fidelity Carbon Manufacturing Co., carbons	viii
Fort Wayne Electric Co	iii
General Electric Launch Co., electric launches	xiv
General Incandescent Arc Light Co., arc lamps	iv
Gleason Manufacturing Co., E. P., electrical appliances	xiii
Greeley & Co., The E. S., supplies	xiii & xiv
Hammond Cleat and Insulator Co., cleats	vii
Harrisburg Foundry & Machine Works, engines	xi
Hart & Hegeman Mfg. Co., switches	200
Helios Electric Co., arc lamps	xiii
Hewett Voltaic Electric Co., compounds	xii
Holmes, Booth & Haydens, insulated wire	vi
Hulbert Fence and Wire Co	vi
Interior Conduit & Insulation Co., motors	vi
Iron Mountain Route	iv
Johns Mfg. Co., H. W., vulcabeston	iv
Laird & Lee, books	vi
Law Battery Co., battery supplies	200
Leavitt Motor Co., motors	xi
Leclanche Battery Co., batteries	ix
Leffel & Co., water wheels	iv
Lehigh Valley Creosoting Co., creosoted lumber	vi
Marshall, Wm., condensers	x
May Bros	xiii
National Electric Mfg. Co., electrical apparatus	ix
New England Butt Co., braiding machinery	vi
New Jersey Lamp & Bronze Works, electric and gas fixtures	xiii
New York Belting and Packing Co., rubber belts	xi
New York Electrical and Development Co	xiii
Onondaga Dynamo Co., electrical apparatus	vi
Ostrander & Co., W. R., supplies	x
Palmer Bros., engine castings	200
Partrick & Carter Co., electrical supplies	x
Penn Life Co., insurance	200
Phosphor-Bronze Smelting Co., castings	xiv
Porter Electric Motor Co., electric motors	xiii
Queen & Co., electrical instruments	x
Reed & Co., F. E., lathes	xi
Ridlon & Co., Frank, general machinery	xi
Ries Electric Specialty Co., regulating socket	vi
Robinson & Orr, steel rails	x
Rose Polytechnic Institute	200
Royce & Marean, electrical supplies	200
Russell & Co., steam engines	xi
Samson Cordage Works, braided cord	vii
Schuyler Electric Co., arc lighting	vi
Shawmut Fuse Wire Co., fuse wire	vi
Shoemaker, Homer, attorney and counselor-at-law	vi
Standard Paint Co., insulating compounds	xi
Stanley & Patterson, supplies	xii
Stanley Electric Mfg. Co., transformers	ix
Stocking, E. B., patent attorney	x
Tyndall, Wm. D., attorney	x
Wanted	200
Washburn & Moen Mfg. Co., wire	x
Westinghouse Electric and Mfg. Co., electrical apparatus	vii
Western Electric Co., supplies	xiii
Weston Electrical Instrument Co., measuring instruments	viii
Whitney Electrical Instrument Co., Instruments	viii
Wilson, Fremont, electrician	x

Nikola Tesla's address "On Light and Other High Frequency Phenomena," delivered before the National Electric Light Association at the St. Louis convention, is by far the most valuable contribution to our knowledge of the subject that we have had from this gifted man. The address will be published in full in the ELECTRICAL REVIEW, and we are indebted to the National Electric Light Association for permission to use it. We understand that it is the intention of the Association to publish the address complete in book form at a moderate price. We feel sure that every one interested in electrical progress will desire to add this book to his library.

ELECTRICITY IN MEDICINE.

The applications of electricity to medicine are becoming more numerous every day. At a recent meeting of the Laryngological section of the Academy of Medicine in this city, Dr. Wendell C. Phillips exhibited an electric head illuminator. A small boy was taken from the audience and a powerful electric lamp was inserted in his mouth, which was then closed on the handle which held the lamp. The lights of the meeting hall were turned down and the electricity turned on. The light in the boy's mouth shone out through his cheeks, detailing every vein, line, or imperfection in the skin and gums in the mouth. His face looked ghastly in its vividness. Another doctor, a prominent specialist in stomach troubles, has devised a novel means of applying electricity internally. He inserts an electrode attached to a long insulated conductor into the throat of the patient whose œsophagus immediately conducts it to the gastric region, where it is ready to serve as one pole for whatever kind of current the operator chooses to apply. By this means there is decidedly a local application of the current to the coating of the stomach, and such diseases as chronic distention of the stomach are treated through the strengthening of the muscles by the action of the electricity.

These two recent applications show that the curative powers of electricity may be applied in most unusual cases, and illustrates the possibilities of more extended uses in the very near future.

ELECTRICITY IN AGRICULTURE.

Taking into consideration the present application of electricity to practical purposes and to its (apart from lighting and traction purposes), somewhat restricted sphere of operations for other objects at the moment, it is not surprising that inquiries made in different parts of the world concerning the use of electricity for working agricultural machinery and implements and in assisting the growth of plants should result in obtaining information of little value at the present time. Such is the result of the endeavors of the United States government, which about a year ago commissioned their consuls and commercial agents in various countries to report upon the utilization of electricity as a power in the operation of farm machinery and implements and in the propagation of plants. It is in the latter direction that the largest amount of experimental work has been done, and Germany and France seem to take the lead.

In the former country, Helmert commenced as early as 1859; he was followed by Fichtner, Tschinkel and Professors Wollny and Holdefleisz, the latter two in 1883 and 1884, respectively. Mr. C. W. Siemens' work in 1880 must, however, not be forgotten, neither must that of the late Sir William Siemens in 1880, and which was dealt with in a paper which he read before the (then) Society of Telegraph Engineers and Electricians. Widely different results have been obtained by the experiments as to the influences of the electric current upon vegetation, and also of the electric light on vegetation. So much is this the case that electricity cannot be regarded as a practical commercial factor in this direction. The same state of affairs is shown by the replies concerning the operation of agricultural machinery and implements by electricity, there being almost the world over no applications of electricity to this purpose. Naturally enough, more attention has been and is being paid to the commercial uses of electricity rather than to experimental work in agriculture or horticulture, but the latter will doubtless receive due consideration at some future time.

DANGEROUS (?) TROLLEY CARS.

If we look deep into the meaning of the word "dangerous" we will find that it is entirely a means of expressing a comparison, and it is very difficult to distinguish the exact dividing line between the qualities "dangerous" and "harmless." No one can tell precisely where one ends and the other begins; there is a haziness between them, so that we may safely assume that there are certain conditions that may exist under which the most harmless thing or act may be changed to the most dangerous. Specifically speaking, the "harmless" banana resting peacefully upon the fruit stand of the street vendor may be quickly changed into a mighty instrument of destruction, doing double duty, in the stomach of a dyspeptic and lying in wait for a victim on a crowded thoroughfare. The most peaceful substance may be converted into the most aggressive. It depends entirely upon the attending conditions.

Reports come in from various parts of the country of the killing properties of the trolley cars, and the blame is laid upon the magic and incomprehensible thing, electricity. They are obviously arrant nonsense. The blame should be put upon the proper causes, viz., defective construction, carelessness and incompetency of the employés and owners.

In a meek kind of way several companies have been experimenting with alleged life guards for the cars. Directors are invited to take a trip to view "the effective working of the new device." Soft scarecrows of assorted sizes, called dummies, are put upon the tracks in various positions, and with the life guard proudly flaunting defiance in the faces of the unfortunate effigies, the motor car bears down upon them. Suddenly there comes a resounding plump, and the dummy is either scooped, shoved, pushed or received by the life guard in a remarkably unfeeling manner, with enough force to disarrange the delicate adjustment of the most solid bones in a human being. The directors applaud; the guards are permanently attached to the cars on the line, and the "examining committee" go home feeling that there is now a great responsibility lifted from their shoulders. The motormeers relax their vigilance, and then—well, Lord help the first victim of the combination of the unfeeling motorneer with the affectionate "scoop net." Let us have safety as the result of continual vigilance.

LETTERS FROM A LABORATORY.—XLVII.

BY JULIAN A. MOSES.

I had recently the good fortune to examine a scrap book, or rather a book of reference, belonging to an experimenter who, having profited by the labors of the "multitude gone before," had collected hundreds of clippings from newspapers, magazines and technical papers relating to applied and theoretical science. It was a particularly interesting volume, consisting of several hundred pages of matter so arranged and indexed as to afford excellent facilities for finding out the location of particular information contained between its leaves.

To explain the method which he employed, I will take for instance a part of a clipping or note which is a good subject to illustrate the system of cross indexing. For example:

"In order to obtain a satisfactory and permanent connection for the carbon element in a bicromate battery, the carbon must first be well copper-plated at one end, and around the copper should be poured melted lead to which may be attached a binding post, etc."

Here we will see, according to the method of analysis which he pursued in the construction of this cross index, that we can divide this sentence into particular heads which may be found under the following subjects, viz., connections, carbon elements, bichromate batteries, copper-plating, lead, uses of, and binding posts. It thus appears that the index is almost as lengthy as the article in question, and that it is merely the subject matter of the article with all of the modifying words eliminated. This is what it really amounts to, and, in fact, a true and well organized index should be so arranged as to give the reader as little trouble as possible in searching for articles which, without an accompanying directory, would be lost in the quantity of matter in a large scrap book, for a thing is indeed lost if we cannot have it at our disposal when it is wanted.

As he obtained his clippings they were immediately pasted into the scrap book entirely irrespective of the subject matter classification, but no time was lost in the indexing under the proper heads. In order to give the designation of the locality of the reference, each page was divided into four columns vertically, lettered respectively *a, b, c, d*, and into six columns horizontally, lettered respectively *a, b, c, d, e, f*. Thus, for example, suppose the article above referred to was in the lower right-hand corner of page 10, and we desired to index it; under the head of "carbons" in the alphabetical index we would write: "fastening connectors to, 10 *df*"; under the other headings we would also add one or two words of explanation sufficient to give an intimation of the context, so that by a series of cross references an index would be obtained which would make it a very simple matter to look up any particular subject desired; and, in addition, it would enable any one unacquainted with the technical part of the article to obtain any information that may be desired, provided, of course, such information were already in the book.

By this means a very large scrap book is prevented from becoming unmanageable; and, if only important and valuable material is primarily inserted, such a volume becomes a valuable addition to a laboratory. Books containing formulæ and recipes are now printed by prominent scientific publishers, and these are often worth much more to the experimenter than he would at first imagine would be derived from the investment of the purchase price.

Where any extensive work is being done the card index is, perhaps, more commodious, but it is more expensive than the written index; for boxes and drawers to contain the file must be made or bought, and their cost precludes the possibility of their general adoption.

If this system be adopted in large works, it will be found that much valuable matter in the current literature may be put to immediate use and laid by for future reference which might otherwise drift pass with the mass of useless material and be lost in the "dim recesses of the past." One of our foremost inventors, recognizing the value of this system of cross indexing, at the beginning of his career employed one of the most intelligent men of the day to make such a volume, which consisted solely of abstracts on one subject from the periodical literature and standard volumes carefully and thoroughly indexed; and to this day much of his success in one direction may be attributed to this collection, which was so arranged as to make any article at a glance thoroughly comprehensive.

CORRESPONDENCE.

OUR BOSTON LETTER.

Work on the Northampton electric road is being pushed forward as rapidly as possible. The Thomson-Houston system will be used and contracts for the motors have already been placed. The power house will be of brick with iron roof and concrete floors, and work will be started on it in a few days.

The Shipman Engine Company have recently delivered two of their eight horse-power stationary engines to J. J. Astor, of New York, to be used in charging the storage batteries of his electric launch. One of the engines will be used in New York city and the other at his summer residence at Rhinecliff on the Hudson.

The Brown Electric Company, of this city, though a comparatively young concern, are rapidly making a name for themselves in the supply business, and are branching out vigorously into the field of electric railway equipment. Among recent contracts of this nature which the company now have in hand is one for the entire electrical equipment of a 12 mile line for the Lancaster, Pennsylvania and Columbia Electric Street Railway Company, a similar one for 18 miles for the South Jersey Traction Company and the extension now under way of the Hartford and Weathersfield Street Railway Company.

The Pettingell-Andrews Company, of this city, has recently brought out the second edition of their illustrated catalogue of electrical supplies, and a glance through its 200 pages of illustrations and prices shows it to be one of the most complete things of the kind ever published. Every article used in the various branches of the electrical industry is illustrated and described in the most thorough manner, and the book may readily be called a mine of valuable information. The products of the celebrated Okonite Company, of New York, for whom the Pettingell-Andrews Company are the sole New England agents, receive particular attention, and their well known trade mark meets the eye on many pages, and holds full sway on the back cover, where it is very strikingly displayed. Electrical men who are not already in possession of this catalogue should send for one without delay, as they will find it of unusual value.

The "Novak" Lamp may now be safely said to have passed the experimental stage, so far as its acceptance among the trade is concerned, as it has certainly demonstrated its commercial efficiency in a most satisfactory manner, and has thoroughly upheld the strong claims made for it by the manufacturers. Since it was first put on the market a month ago, the sample orders from all over the country, running in lots of from six to a dozen each, have averaged over 1,500 lamps per day, and from no one of these has a single complaint been received. These orders are, of course, entirely outside of the regular trade, and only go to show how wide is the interest felt and to what extent is the demand for a better lamp felt. The company have increased their daily output very materially during the past two weeks, and are now turning out between 3,500 and 4,000. Messrs. Claflin & Kimball report a steady increase in orders, and new apparatus is being installed to enable them to keep pace with the demand.

The Proposed Electric Line between Haverhill and Danvers, a franchise for which has just passed the Legislature, seems likely to go no further for some time at least, from the fact that the clause granting the railroad company the privilege of supplying electric lights and power to the towns through which it passed has been stricken out, and without this privilege the company do not see their way to make it prove a financial success. The citizens of the towns along the route are greatly disappointed at the turn affairs have taken, as the announcement of the proposed road had already created a little boom in real estate, and they expected many advantages from the opening of the new line. Petitions are to be circulated asking the Legislature to grant the company the privilege of furnishing lights, as it is the only opportunity these towns will have of getting them, none of them being large enough to afford an electric plant of their own. It would be a good thing for all concerned if the matter should go through, as the construction of the road would be begun at once and the additional revenue from lights would help materially to put it on a paying basis.

The Eastern Electric Light and Storage Battery Company, of Lowell, Mass., have at last settled their difficulties with the Consolidated Electric Storage Company, of New York, and are now licensees of that company under the Brush patents. Their storage batteries for electric lighting, and their portable batteries for phonographs and dentists' use, are meeting with an unusually large sale, and at present they find great difficulty in keeping up with orders. The development of the storage battery business has for years been greatly retarded and in fact almost killed by constant litigation, and even now the exceedingly high tariff demanded from licensed companies, and the consequently high price at which they are held, prevents their general adoption to a very great extent by those who would otherwise be glad to put them to practical use. In view of these facts, the outcome of the case of the Brush Company against the Milford and Hopedale Storage Battery Company, which is now under consideration by Judge Colt in the United States Circuit Court here, is awaited with considerable interest. Should the defendant company succeed in winning their case, the entire situation would be materially changed, and the storage battery interests would then receive the attention to which they are entitled, and which, under existing circumstances, is out of the question.

Boston, May 27. H. G. T.

OUR CHICAGO LETTER.

Among those who have this week completed their exhibits is the Standard Electric Company of this city, who have made a very creditable display, as has the Elektron Manufacturing Company, of Springfield, Mass.

The North American Phonograph Company, at their exhibit in the Electricity Building, are giving away a very neat desk blotter and calendar combined, which is in great demand by those fortunate enough to have their desks in shape to use.

Mr. W. W. Primm, formerly draughtsman in the Department of Electricity, has been promoted and now holds the title of engineer for the Department of Electricity. Mr. Primm has made many friends since his duties began here, who wish him all success possible.

Recent Testimonials Received by the Jenney Electric Motor Company from the Parry Manufacturing Company, of Indianapolis, Ind., and A. C. Bingham, of Boston, Mass., in appreciation of the excellent service which their machines are giving, must be most gratifying to this company.

Messrs. Clark & Marshall, the well-known electrical supply dealers of this city, have moved their office to No. 345, "The Rookery." They have also engaged a larger storeroom, and are now carrying a big stock of specialties which will enable them to take care of the trade in better shape than ever.

The Work in Electricity Building, which is being pushed rapidly, does not as yet resemble the grand display which was expected there would be. Everything possible is being done, however, to get the building in a finished condition, and it is safe to say that within a short time everything will be in place and the Electricity Building, as heretofore stated, will be one of the central attractions of the Exposition.

The New York Belting and Packing Company, No. 15 Park Row, New York, have installed a very artistic exhibit in Machinery Hall, which does honor to this well-known firm. They have erected a pavilion built entirely of rubber, consisting of belting, hose, couplings and numerous articles used commercially. The figures and draperies are of rubber also and make a most novel and grand display, and one that attracts much attention.

The Ansonia Electric Company intend to take care of their customers and friends who visit the World's Fair this season in royal style. Invitations have been issued requesting all who visit the city this year to consider their club rooms, which occupy the upper floor of their building, corner of Michigan avenue and Randolph street, their headquarters during their stay. Mr. George B. Shaw is in charge of the entertaining committee, and also has charge of the exhibit at the Fair grounds, and it is safe to say that those who accept their courtesies will be highly entertained.

Chicago, May 25. M. J. B.

"Electricity" Sued For Libel.

Burton E. Greene, editor and publisher of *Electricity*, published at 6 Park Place, New York, was indicted for criminal libel on May 25, and gave $1,000 bail on May 27 to appear for trial. L. P. Mendham, of 212 East Twentieth street went on his bond.

The indictment was found on the complaint of Chas. A. Coffin, president of the General Electric Company, who charged that Greene published in *Electricity* on May 17 a statement to the effect that the company had failed to meet some of its obligations promptly, and was not in good financial condition. Mr. Coffin was represented as making this acknowledgment.

In these days of financial stress and depression it is encouraging to note that electrical development continues successfully in all its branches. Our modern electrical inventor is not easily disheartened. If he cannot invent things under luxurious circumstances he will use what is at his hand to accomplish his object.

The Lady Electricians' Union Meets Again.

The following very polite invitation was received at the office of the ELECTRICAL REVIEW, which paper had the good fortune to report exclusively the first meeting of the Lady Electricians' Union:

MY DEAREST SIR:—I have the honor of extending to you the hospitality of the Lady Electricians' Union at their next meeting, to be held at the rooms of Mrs. Lanworthy, No. 41144 Fourth avenue.

By order of the president,
ISABELLA MCCORKER,
Secretary.

Upon the receipt of this letter, the reporter for the REVIEW hied himself to the place mentioned, and thus records the consequent interesting meeting:

Mrs. Delia Lafferty, with a peremptory and vicious rap of the gavel, called the meeting to order.

"Ladies and gentleman," here she looked at the reporter and smiled one of her most winning smiles. "Oi hope that ye all read the most highly interistin' account av our last meetin' in that iligant an' respectful newspaper, the ELECTRICAL REVIEW." (Extended applause, which caused the reporter to blow his nose vigorously to hide his confusion.) "Well, I must t'ank him in th' names av all the ladies prisint fur his very nice report, which it wuz." Here Mrs. Lafferty arranged three hairpins in her Bernhardt bang, and proceeded. "Notwit'standin' that the object av this meetin' is to raise our voices aginst th' most insultin' advertisemint which wuz iver put into print—an advertisemint that is a disgrace to anny individual what wears pants, prisint company excepted. And th' advertisemint to which I refer, is this."

Here the president brought out a copy of the ELECTRICAL REVIEW which contained the notice on the inside front cover to the effect that there was "A Hen On."

"Th' man what put thot vile insinuation aginst th' fair sex into print, deserves to be electrocuted, which he should be."

Hereupon Mrs. Isabella McCorker interrupted, and, as she brought her No. 12 glove down upon the table with considerable vehemence, she said:

"Ladies, Oi am av th' opinion which our worthy prisidint has so foinely explained, an' Oi t'ink we should write a note to th' papers sayin' that we protist aginst such riference to the fair sex."

"Ach, mein Gott!" interjected Mrs. Weisenschnipper, "ain't dot yust vat der bresidend sayed; vat for you vant to repeat vunce? Don'd you suppose der reborter knows vat der bresidend sayed?"

At this juncture Mrs. Lanworthy thought she would take a hand in the discussion, and, with a withering glance of superior wisdom upon the unfortunate Mrs. Weisenschnipper, took the floor.

"Mrs. President, may I have the floor?" she asked.

"Ain't ye got it already?" snapped Mrs. Lafferty.

"Well, then, if I've got it, I will keep it for a few moments," and she smiled beamingly on the assembled ladies, as much as to say, Wait till you hear what I have got to say.

Addressing Mrs. Weisenschnipper, she said: "I hope you will not interrupt us with any of your Dutch remarks while I am giving to you all some information which you should know. Ahem! I, too, have had some thought on the subject of this disgusting advertisement reflecting discredit upon the female sex, and I have looked the matter up before venturing to air any of my spite. Ahem!" Here she looked intensely for a few seconds at Mrs. Lafferty, but that lady never moved a muscle. "Upon discussing the subject with a few of my most intimate friends, including ex-Mayor Grant, Mr. Croker and Mr. Cleveland, I arrived at the conclusion that such a phrase must have had some diabolical derivation; so, upon looking up the matter, I found the following."

Here Mrs. Lanworthy took from some hidden recess in her crinoline a huge volume, carefully bound and covered with brown paper, and printed on the back in large, black letters, so that while she read the volume in the cars she graciously permitted every one to view with curiosity the quality of the literature in which she indulged, were the words, "D'Israeli's Curiosities of Literature." She let the Union have a good look at the cover, and, in an impressive voice, after several successive ahems, she said:

"Ladies, on page 395, of this most valuable book, 'D'Israeli's Curiosities of Literature,' ahem, I find the following, which I will read:

"When Rinaldo delgi Albizzi was banished by the vigorous conduct of Cosmo de' Medici, Machiavel tells us, the expelled man sent Cosmo a menace in a proverb, *La gallina covava*, 'The hen is brooding,' said of one meditating vengeance. The undaunted Cosmo replied by another, that 'There was no brooding out of the nest.'

"Here you see, ladies, is the derivation of this allusion to the fair sex." She sat down.

All the room was in a state of hushed admiration for the intellectual supremacy of Mrs. Lanworthy, but of a sudden, Mrs. Lafferty, realizing that she was losing her grip upon the presidency, said, in a most authoritative tone:

"Mrs. Lanworthy, Oi don't see what you bring up those ould fossil facts for; they ain't got nothin' to do with electricity. This meetin' was fur the purpose av resintin' an attack which has been perpetrated in th' electrical press, alludin' to the subject of there bein' a hen on, and I claim that this is an allusion to our Union, an' I don't t'ink this is right, which it isn't. Why, in the very same paper that th' notice av our meeting appeared, was this disgustin' advertisemint. The idea av usin' the female av anny animal to advertise anny scheme, an' moreover, I t'ink that Mrs. Lanworthy's remarks don't amount to a tinker's——."

At this point Mrs. Lanworthy jumped up and hissed: "Ladies, you will all see that Mrs. Lafferty don't know what she is talking about, and——."

"Donnerwetter," exclaimed Mrs. Weisenschnipper, "dose Irish vimmens vas gettin' a fight in; I guess I gets meinself oudt."

"Dear ladies," put in the reporter for the ELECTRICAL REVIEW, "pray do not quarrel over such a trifling matter. I shall have the objectionable advertisement referred to taken from the paper and another put in its place, and if any of the ladies should happen to have a large sized thirst at present, I shall be most happy to allow the gentleman at the grocery store to supply them with what they would be pleased to have."

"My!" exclaimed Mrs. McCorker, "but thot young man's got a high forehead."

And as the reporter left the field he heard Mrs. Lafferty remark to Mrs. Lanworthy, in a pleasant tone of voice, "What ye goin' t' take?"

A Necessary Modification of Ohm's Law.

Mr. Fernando Sanford has determined the resistance of a copper circuit containing various dielectrics, and has come to the conclusion that the resistance depends to an appreciable extent on the dielectric. The copper circuit in his experiments took the form of a double-ended cylinder, having a wire attached to the center of the lower end and passing through an insulating bush in the upper one. This was filled with various dielectrics, and curves were taken of its resistance at various temperatures over a range of 10 degrees C., by a bridge capable of measuring resistances within 0.00001 ohm with a fair degree of accuracy. Air and petroleum were compared by means of series of observations extending over two months, the dielectrics being changed five times, and the results were perfectly consistent. The author found that if the conductivity of the copper in air be taken as unity, its value varies from 1.0018 in petroleum to 0.9973 in a mixture of wood alcohol and petroleum—a range of nearly half per cent.

He finds that it is probable that only the part of the dielectric in direct contact was concerned in the effect, as until it was thoroughly cleaned and dried the cylinder did not return to the value unity. A silver wire shows the same effect to a less marked degree.

Bombe & Suchhard's Combined Arc Lamp and Incandescent Lamp System.

All arc lamps, arranged in series or in parallel, use an inert resistance which absorbs about 30 per cent. of the electrical energy passing through the lamp. This resistance is needed for the proper regulation of the lamp, to provide a steady light, and to overcome occasional fluctuations of current either in the lamp proper or in others in circuit therewith. All this energy is transformed by the rheostat or resistance coil into heat and represents an absolute loss.

To employ usefully this excess of current has been the aim of numerous electricians. One of the most promising schemes would be the substitution of incandescent lamps in place of the present inert resistance. Instead of introducing incandescent lamps, second-

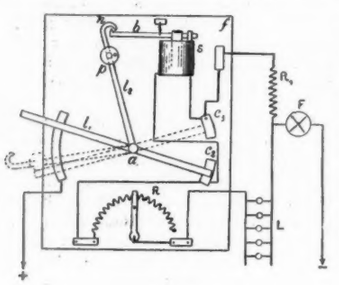


FIG. 1.

ary batteries or electromotors may be employed, but such substitutes are cumbersome and require additional devices to prevent their destruction by excess of current.

An arc lamp requiring nine amperes shows 40 volts at its binding posts; generally, however, 65 volts are allowed for its operation, and the excess of voltage is consumed by an additional resistance.

A lamp using from 12 to 15 amperes requires 43 to 44 volts, but to ensure its satisfactory operation, the voltage must be increased with the addition of a resistance coil.

Again, though a nine ampere 40 volt lamp should operate with 360 watts, it needs 25 additional volts, absorbed by proper resistance, which increases the actually consumed energy to 585 watts, or a dead loss of energy amounting to 38 per cent. Two nine amperes 40 volt lamps in series necessitate a loss of 27 per cent. These few examples well illustrate the excessive loss of energy inherent in our present arc light systems.

It is evident that when we attempt to substitute incandescent lamps for the inert resistance, the resistance of the lamps must equal that of the rheostat. If we now insert these lamps in series in a circuit containing two arc lamps, also in series, their regulating mechanism will continue to work satisfactorily, and the current fluctuations caused by the constantly changing position of the carbons are scarcely noticeable.

Referring again to the above mentioned nine ampere 40 volt lamp on a line supplying 65 volts, it is easy to calculate the ohmic resistance which should be added to consume the excess of voltage, *i. e.*, 25 volts. The resistance necessary is 2.77 ohms. Now, what number of lamps would replace that resistance?

It is generally stated that a 16 candle-power lamp uses 55 watts. Assuming this statement to be reliable, we have at our disposal 25 volts. But as $W = C \times E$, or, $C = \frac{W}{E} = \frac{55}{25} = 2.2$ amperes. In other words, an arc lamp using nine amperes would furnish sufficient current for 8.8 incandescent lamps using 2.2 amperes.

Again, as $C = \frac{E}{R}$, and substituting the given values, we find that we may replace the incandescent lamps by 11 36 ohms resistance.

In other words, these lamps, while burning, have a resistance equal to 11.36 ohms. Thus we must place a number of lamps in parallel until their total resistance equals 2.77 ohms. This number is found by dividing $\frac{11.36}{2.77} = 4$ lamps in parallel.

Another practical illustration may be of interest. Given 110 volt circuit operating two 9 ampere 40 volt arc lamps in series; there is an excess of 30 volts which must be consumed by additional resistance or $\frac{30}{9} = 3.33$ ohms. We may substitute a 25 candle-power 30 volt lamp using 82.5 watts, which lamp requires $\frac{82.5}{30}$ or 2.75 amperes. Dividing this figure by 9, we find the number of lamps which we can substitute for the additional resistance, *i. e.*, three lamps. If it is desired to employ a lamp of lower candle-power, say for instance, 16 candle-power, the number of lamps required for substitution would be 5.

But what happens if one of these lamps is extinguished? Evidently there is at once an increase in resistance and the current decreases, reducing simultaneously the efficiency of the incandescent lamps. In other words, one may purposely turn off one or two of these lamps, thus saving electrical energy, a feature which it is impossible to accomplish with arc lamps using inert resistances. Of course the current can only be decreased up to certain limits.

It follows then that in systems in which arc and incandescent lamps are jointly operated, there is a considerable saving in operating expenses. Taking into account that most of our cities are lighted by arc lamps, employing useless resistances as regulators, it at once becomes apparent that the substitution of incandescent lamps for such inert resistances is a very important matter.

We have mentioned above that in place of incandescent lamps secondary batteries may be employed. The portion of current so diverted serves to charge the batteries, say during the hours of the night and they may be utilized to give current during day-time.

While the substitution of incandescent lamps for the inert resistance of an arc lamp is clearly a desideratum, the proper electrical solution of the problem is rather difficult. One of the most promising arrangements has been invented by Messrs. Bombe and Suchhard. It requires the introduction of an automatic switch represented in Fig. 1.

It consists of two levers l_1, l_2 which move independently and are attached to the pivot

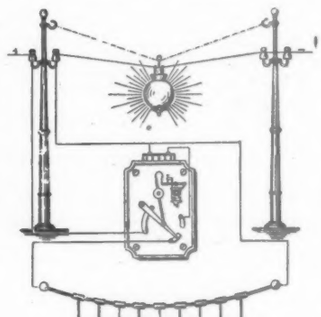


FIG. 2.

a. Lever l_1 carries on its inner side friction plates which glide over contacts c_1, c_2, c_3. Lever l_2 carries a weight, *p*, and is hook shaped at its upper end. The prolongation of l_2 projects over the armature, *b*, of solenoid, S, and thus is in mechanical connection with the latter.

A separate resistance R is provided to regulate the light intensity of the lamps should the line current unduly increase.

The current enters at the positive terminal passes over contact c_1, c_2, by lever l_1, thence through R, lamp L, the arc, F, and returns through the negative terminal. The switch is in parallel circuit with the lamp L; one portion of the current traverses the convolutions of the solenoid S, resistance R_1, lamp F, and returns to the source of electricity. The resistance of S exceeds, by far, that of R_1. Again the solenoid is out of the current when the lamps are not in use.

As soon as the core is drawn into the solenoid by an increase of current, armature *b* permits lever l_2, on account of the weight P, to fall upon l, taking the position shown in dotted lines on c_2. The current is then as follows: Along c_1, l_1, c_2, R_1, F, the line being open at c_2. At the same time the lamp circuit is discontinuous and the solenoid is short circuited. It is advisable to place l_1 on c_3 until the arc is well established; then the incandescent lamps may be introduced.

Fig. 2 shows the system. The resistance of coil S permits a current of only .15 to .20 ampere to circulate therein during the burning of the incandescent lamps. The tension of the device opposing the action of the armature is so arranged that l_2 operates on a fluctuation of current of three quarter volts.

The above described apparatus facilitates also the quiet burning of the arc lamps. In practice it has been found advantageous to place from 12 to 15 sixteen candle-power lamps with a single arc lamp without in any way increasing the output of electrical energy, and the first expense of such an additional device is fully recovered within the first year.—*Dieudonné in l'Electricien.*

Preliminary Programme of the International Electrical Congress

TO BE HELD IN CONNECTION WITH THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, BEGINNING AUGUST 21, 1893.

The opening session of the General Congress will be held on Monday, August 21, at 3 o'clock, P. M.

ORDER OF BUSINESS.

1. The congress will be called to order by the chairman of the local committee, Dr. Elisha Gray, Highland Park, Ill.
2. Election of temporary chairman and secretary.
3. Appointment of a committee to nominate permanent officers. The officers will consist of a president, a vice-president for each nation sending delegates to the chamber, a secretary.
4. Report of this committee.
5. Short addresses by the president and by a few of the vice-presidents.
6. Announcements and adjournment.

At the close of this meeting the chamber of delegates will assemble for preliminary organization, which will proceed as follows:

1. The chamber will be called to order by one of the delegates representing the United States.
2. Election of a temporary secretary.
3. Appointment of a committee of five on credentials.
4. Fixing a time for regular sessions. Adjournment.

At the next meeting of the chamber the committee on credentials will report, and a permanent organization will be completed.

The General Congress will be divided into three sections, as follows:

A. The section of pure theory, including electric waves, theories of electrolysis, electric conduction, magnetism, etc.

B. The section of theory and practice, including studies of dynamos, motors, storage batteries, measuring instruments, materials for standards, etc.

C. The section of pure practice, including telegraphy and telephony, electric signaling, electric traction, transmission of power, systems of illumination, etc.

These sections will meet for organization and work at 10 A. M., August 22. Their organization will consist of the election of a chairman, a vice-chairman, a secretary and a sectional committee of three, in addition to the officers named above. Temporary presiding officers will be as follows:

Section A—Prof. H. A. Rowland.
" B—Prof. Charles R. Cross.
" C—Prof. A. Graham Bell.

Sections will meet at 10 o'clock A. M., on Tuesday, Wednesday, Thursday and Friday, continuing in session at will, except on Friday, when they will finally adjourn as sections not later than 1 o'clock, P. M.

Each section will have authority to divide into sub-sections if it is thought to be desirable.

Papers are solicited upon the following subjects, or upon other topics which may be considered suitable in character.

They should be sent to the chairman of the programme committee not later than August 1, 1893. Such as are accepted by that committee will be put upon the programme of the Congress, to be presented in full or by abstract according to the time available.

Magnetic units and modes of embodying them in concrete standards.
Methods of avoiding electrical interference and risks to person and property.
National and municipal testing laboratories.
Materials for standards of electric resistance.
Points of difference of the electrical vocabulary used in different countries.
The direct conversion of the energy of fuel into electric energy.
Comparison of the various methods employed for the electric transmission of power.
The cost of insulation in relation to high pressure for the electric transmission of power.
Comparison of the economics of the various systems of electric distribution.
Alternate current motors.
The behavior of transformers when supplying power to alternate current motors.
The construction of condensers for alternate current purposes.
The measurement of power in polyphase currents.
Direct coupled and non-direct coupled dynamos.
The use of equalizing dynamos in a three and a five-wire system.
The use of accumulators in central stations.
The proportions between output of dynamos and the weight of copper and iron employed in their construction.
Electric traction.
Application of electric power in mining.
The adoption of a uniform method of distinguishing positive and negative mains.
Electric supply meters, American, British, Continental.
Criterion of sensibility of galvanometers.
Commercial instruments for measurement of electric quantities.
The relation between the voltage of the arc and the quality and composition of the carbons.
The aging of glow lamps.
The electric working of metals.
The use of electric and magnetic tests for ascertaining the mechanical properties of metals and alloys.
The best material and mode of erection of lightning conductors in the light of recent researches in electric discharges.
The prospecting for iron by magnetic surveys.
International telegraphy.
Fast speed and long distance telegraphy.
The use of batteries or other generators for telegraphy.
Telegraphic lines—land and sea.
Harmonic telegraphy.
Writing telegraphs.
Long distance telephony.
The possibility of providing telephonic communication without wires.
Application of electric signaling to the working of railways (alarms, time, etc.), and to naval and military purposes.
Magnetic separators.
The use of electricity in engraving and in art reproductions.

The time allotted to the discussion of the papers presented will be determined by the several sectional committees. In the discussion of papers the chairman of the section will name the first speaker.

The "General Congress" will include a smaller body, to be known as the "chamber of delegates," which will consist of those specially designated as representative delegates from the various governments, appointed for the purpose of considering electric units and their values, and making recommendations as to the legalization of the same.

The following topics will be considered by the chamber of delegates:

Adoption of definitions and values of fundamental units of resistance, current and electromotive force.
Adoption of definitions and values of magnetic units.
Adoption of definition and value of the unit of self-induction.
Definitions and values of light, energy and other units.
The standardization of electric lights.
The consideration of an international system of notation and conventional symbols, and of a more uniform and accurate use of terms and phrases in electrical literature.
A commercial standard of copper resistance.
Together with such other topics as may properly come before the body.

The hours of meeting for the chamber of delegates shall be determined, after the first session, by the chamber itself; and it shall also decide upon the admission of persons not delegates to its sittings.

It shall finally adjourn not later than 1 o'clock, P. M., on Friday, August 25, and at the last meeting of the general congress the officers of the chamber shall report to it a summary of its proceedings and the conclusions reached.

Public lectures of a popular character will be delivered by eminent electricians, at 8 o'clock P. M., on Tuesday, Thursday and Friday of the congress week.

The general congress will assemble to hear reports and for final adjournment at 3 o'clock P. M., Friday, August 25.

Prof. T. C. MENDENHALL, Washington, D. C., *Chairman.*
CARL HERING, Philadelphia, Pa.
Prof. W. A. ANTHONY, Manchester, Conn.
Prof. H. A. ROWLAND, Baltimore, Md.
A. E. KENNELLY, Orange, N. J.
Prof. F. B. CROCKER, New York city.
Prof. E. L. NICHOLS, Ithaca, N. Y.
Prof. H. S. CARHART, Ann Arbor, Mich.
Committee on Programme.

The General Electric Company's New Street Railway Motor.

The efforts of street railway electrical engineers have been for some time past concentrated on the improvement of the street railway motor. Almost all motors in use heretofore have been to some extent marred by shortcomings, which eliminated, would render the device more efficient and more perfectly adapted to the needs of improved street railway service. Not the least of these shortcomings was the weight of the

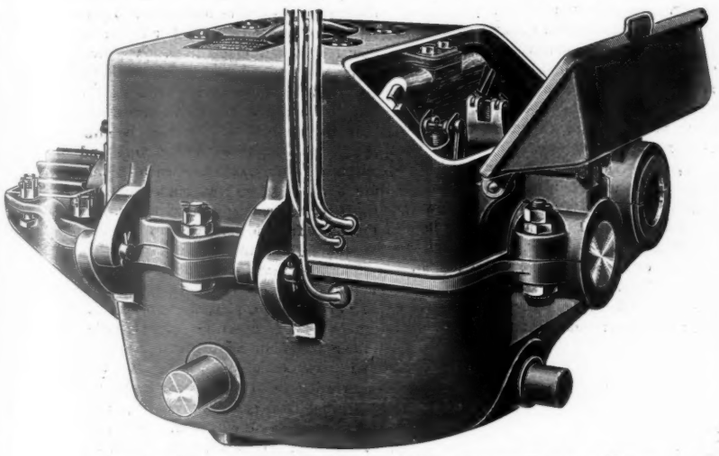


FIG. 1.—GENERAL ELECTRIC COMPANY'S NEW STREET RAILWAY MOTOR.

motor itself, on account of the influence which this item alone has upon the amount of money expended upon keeping the tracks in good repair.

From the new motor, known as General Electric 800, which the General Electric Company has just put out, the shortcomings which have characterized many other motors, and which have been rendered evident under actual working conditions, are said to have been to a great extent eliminated or modified.

The nomenclature of 800 has been given to this motor as indicating its ability to exert a horizontal effort of 800 pounds through a 33 inch wheel continuously in ordinary street railway service. This rating is more accurate than that customarily employed, and adopting the General Electric Company's usual conservative method of rating in horse-power, the motor becomes a 25 horse-power motor.

It is a four pole motor of new design. Its principal characteristic and one that will recommend it especially to street railway men, is that it is the lightest street railway motor, for a given out-put, yet presented. This matter of reduction of weight has been studied with considerable care, with a view of meeting the demands of the continually growing street railway business. The question of preservation of tracks is one of deep importance to every operating electrical street railway company. The extent to which it usually figures on the balance sheet has shown that errors must no longer be made, and has created a demand for a motor light enough to reduce the wear and tear of track to a minimum. The motor in question is even lighter than the 15 horse-power motor formerly sold by the General Electric Company. It is not less than 660 pounds lighter than the old S. R. G. 15 horse-power motor, and some two or three hundred pounds lighter than the W. P. 15 horse-power.

In suspending this motor on the cross frame of the truck, it will be so hung that only 500 lbs. of its weight will bear directly on the axle. From this it will readily be seen that the dead blow delivered from the axle to the track is greatly reduced.

The aperture necessary for the purpose of inspection, cleaning, etc., is so designed that when closed, those parts which could be damaged by water—the brush holders, commutator, armature and field spools—are so enclosed in a water-tight box that the entire motor could be immersed in water and still operate as under normal conditions. This advantage is one which can be easily appreciated by those engaged in the practical operation of electric railways, since it renders the motor of equal value in either summer or winter service, in either bad or good weather.

This closing of the motor so as to make it water and dust proof has been rendered possible by its superior design and the liberal use of copper and the best grade of steel in its construction, whereby the heat generated in the motor has been materially reduced. The motor, even closed up as it is, runs much cooler than previous motors that were entirely exposed. It can be taken apart with the utmost facility. The top frame is hinged on to the lower frame and with its proper parts weighs only 350 pounds. On the removal of only two bolts it can be thrown back completely out of the way of the armature, or by the removal of the hinge pins the top frame can be lifted into the car, or by moving the nose plate forward the motor can be swung upon the ring axle as a hinge so as to be accessible from the pit, the top field then being swung on its hinges still lower into the pit, in which position the armature and field spools can be easily removed; or by the removal of the top of the gear case and two axle caps the motor can be lowered as a whole into the pit. The armature is short and can be lifted through an ordinary trap door. It will thus be seen that the motor can be handled either inside the car or from without with almost equal facility. On opening the lid over the commutator easy access is had to the whole width of the commutator and brush holders, the latter being of the simplest possible construction and easily operated with one hand. The bottom of the armature is two inches above the pit of the motor, so that it is not liable to be injured by articles falling inside of the motor frame. The construction is such that it is practically impossible for any grease to get inside of the motor at present.

The armature is similar to that used on the well known W. P. motors, and is made both in the Gramme ring type and in the drum form. The drum winding has been carefully studied, and the many objections to the various kinds of drum windings that have from time to time been put upon the market have been carefully guarded against. The Gramme armature and drum armature are interchangeable.

No point of fault which motors of all makes have manifested has passed unstudied, and in the motor under consideration the General Electric Company believes that it has been able to do away not only with the ordinary defects, but also those which only declare themselves under certain contrary and extraordinary condition. The electrical qualities of the machine have been subject to several months of stringent test under actual service conditions with most successful results.

Work is being rapidly pushed on Cedar street in Lancaster, Pa., by the Columbia Traction Company, on their Chickies extension. Sixty men are at work grading and 25 men are working on the ballast.

ELECTRIC RAILWAY AND POWER NOTES.

Surveys of Baltimore and Ellicott City, Md., Electric Road have been completed.

The survey of the electric road from Findlay to Fostoria, *via* Van Buren, O., is complete.

The electric street railway system of Escanaba, Mich., will be extended this summer.

There is a prospect of an electric road being established between Bangor, Orono and Oldtown, Me.

Over 5,000 people were carried in one day last week over the trolley road between Media and Chester, Pa.

The new electric street car line at Green Bay, Wis., is to be extended to the new industrial town of Allouez in the same State.

The Lake Shore Railroad Company will introduce the automatic electric system of signals between Toledo and Buffalo. The Union Switch and Signal Company, at Swissvale, Pa., has commenced work on the order.

The new electric road between Oakland and Alameda, Cal., was put in operation last week for the first time. The cars run very smoothly and are of the latest design. Trips will be made from 6.15 in the morning until midnight.

One of the most interesting features of the last annual report of the Westinghouse Electric Company is the announcement that the directors have decided to erect extensive works at Wilmerding, Pa., at a cost of not more than $500,000.

This week the new branch of the Oakland, San Leandro and Haywards electric line to San Lorenzo, Cal., will be opened for business. The spur is two miles long and connects with the main line at what is known as San Lorenzo junction. Cars will make half-hourly trips.

The new electric line between Watertown and Waltham, Mass., was opened last week and more than 2,000 people rode before the close of the day. People in the wide-awake towns of the State are ready to welcome public conveniences.

The officials of the Frankford and Southwark Railway Company, of Philadelphia, Pa., have been watching the workings of a storage battery electric car on the Lehigh branch for the last two weeks. The system, it is said, has proven to be completely satisfactory.

The Shaler & Hall Quarry Company, of Portland, Conn., are to use electricity for pumping out the quarry soon. The wires have been run and and the generator is now at the electric plant ready to be put in order. Incandescent lights will soon be placed in the business houses of the town and also many of the residences. Two hundred and fifty lights have already been ordered.

The contractors are pushing the work on the power house of the Fond du Lac, Wis., Light, Power and Railway Company. The walls are up one story and the boilers are being put in place. Several streets are already provided with incandescent lighting wires, and trolley wires, for the street railway, are expected daily. It is expected that everything will be ready for operation by June 1.

Work on the Electric Railway in Springfield, Mass., began last week under the supervision of Superintendent Clark. A contract for 225 tons of new steel rails has been placed with the Pennsylvania Steel Company. The contracts for motors, dynamos, cars and power will probably be made this week, and it is expected that in less than two months electric cars will be running through the city streets.

The Traction Company, of Reading, Pa., have put a force of 30 men at work connecting the tracks of the East Reading Electric Railway, now a leased line of the former company, with Miller's Park. The line of the East Reading Electric Railway runs on Nineteenth street to near Cotton and the additional track is being laid on Nineteenth street to Miller's Park. This will be the third line of railways running to this park.

The Ossining Electric Railway Company, of Sing Sing, N. Y., which has been promising to have its road in operation by June 1, is progressing so slowly with the putting up of its poles and string of the trolley wires that little hope is entertained that it will be able to realize its expectations. This company has made application to the board of town officers for permission to extend its Spring street branch from the south corporation line to Sparta.

The Pennsylvania Traction Company's surveyors have commenced work upon the electric line from Middleton to Philadelphia. They will also build lines from Parkesburg to Oxford, from Dowingtown to Guthreville and from West Chester to Philadelphia. B. J. McGrann, of Lancaster, has been awarded the contracts for the road bed of all the lines, and the Westinghouse Company will furnish overhead work. The company is backed by a capital of $30,000,000.

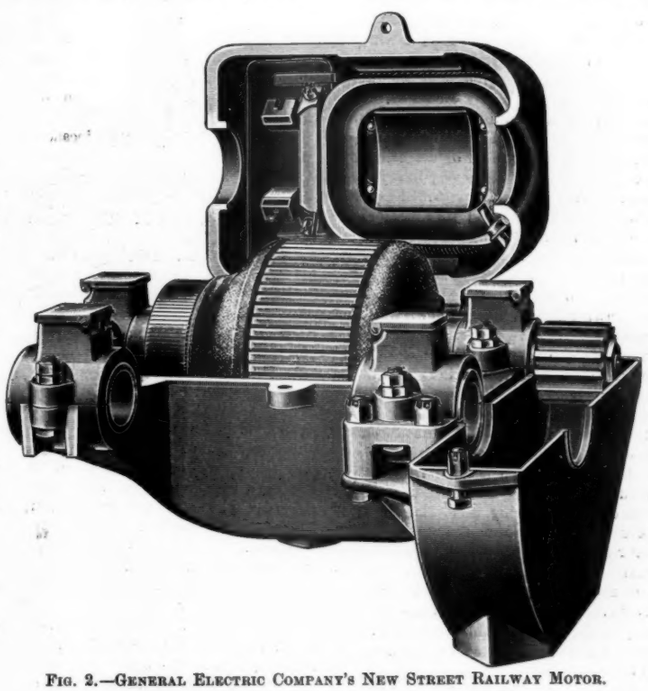


FIG. 2.—GENERAL ELECTRIC COMPANY'S NEW STREET RAILWAY MOTOR.

Wall Street and the Electrical Stock Market.

The features of the market during the week were the continued onslaught in General Electric, the publication and reception of the Richmond Terminal plan, the stock jobbing operations in Distilling, the increase of two per cent. in the dividend on Consolidated Gas, the continued exports of gold, easy money on call in the face of higher rates for time loans, and a continuation of the feeling of distrust on the part of capital towards investment.

The Richmond Terminal plan has not been sufficiently long before the public to receive a full expression of opinion. It involves the welfare of some $375,000,000 of various securities, which are of all classes, from the very bad to the gilt edged. Some receive more favorable treatment than others. Those who are entirely unprejudiced express the belief that the plan is a fair one and will go through. Its consummation will materially strengthen financial interests both in the East and in the South.

The continued failures of banks and mercantile firms throughout the country tends to augment the feeling of distrust on the part of capital towards time loans. There is plenty of money in the banks which can be had at a very low rate of interest on all, or upon the best security. The business of the country is conducted with about 10 per cent. of money and 90 per cent. of credit, consequently when credits are being curtailed, names scrutinized and a general discrimination enforced, the effect can readily be realized. The business world of to day is passing through the same experiences which fell to the lot of Wall street three weeks ago. The end is not yet, although it is believed by many of the conservative classes that it is in sight.

General Electric was decidedly the feature of the week. The highest price at which it sold was 79 on Monday, the lowest 65 to-day. It was very active throughout the week, fluctuating several points each day. The tendency was downward and the movement was only checked by the various semi-official statements of the officers of the company. It closed the week with a very heavy short interest and was generally regarded as a sale rather than a purchase. Its decline from 110 to present figures has been steady and has undoubtedly been largely influenced through the selling of long stock. There appears to be little or no support beyond that of a merely speculative nature. The short interest which has been active have all along stated that the affairs of the company were not as it should be, and these statements, reiterated with so much apparent earnestness, created a feeling of general distrust which gave way to one of open conviction when the announcement was made that the company had sold 15,000 shares of the Edison Electric Illuminating stock which it held in its treasury. This, immediately following, as it did, a sale of 5,000 shares of the Boston Illuminating stock, was regarded as a pronounced confession of weakness, and many who had held on to their stocks expecting a rally threw it upon the market. This resulted in a decline from 73⅛ to 69⅞. About this time the officers gave out a semi-official statement in substance as follows:

The company has realized that a determined attack was being made upon its credit, and to place itself beyond the possibility of its harm, it has adopted the policy of increasing its cash resources by the sale of such portions of the securities of local companies, now in its treasury, as can be easily and profitably made. So far the company has sold $2,000,000 of these, and proposes to sell others from time to time. It has on hand about $7,000,000 of these. Negotiations for their sale are now in progress. The company has a comparatively small amount of outstanding debt. The entire amount of such obligations during the next 60 days is less than $500,000. The company has on hand, besides the proceeds of the sale just made, in cash, $1,500,000. The entire outstanding obligations of the company, including long time paper, are but slightly in excess of the cash on hand plus the amount to be received from the various securities recently negotiated.

This statement had a tendency for a time to check the decline. After it had been analyzed by the Street the general opinion was that the company's condition was less favorable than was generally thought. About this time rumors of a strike among the 4,000 employés at the Lynn works were numerous. The bears concentrated their effort, and to-day made a savage drive at the stock, carrying values down over five points, to 65, a subsequent rally closed the stock at 67.

There are all sorts of stories afloat in the Street regarding the property, and general belief prevails that it will go considerably lower. The stock ticker very seldom lies, and it indicates very strongly that the company will either be compelled to reduce or pass its August dividend. If this be the case the stock will sink below 40.

The Edison Electric Illuminating stock was comparatively inactive in the open market, ranging between the figures given in the attached table. On Thursday, upon the announcement of the sale of the block of 15,000 shares held by General Electric, the stock dropped off three points to 108½. However, it immediately rallied. The price of this stock is mooted. We understand, upon good authority, that it was 105. The purchaser, Kuhn, Loeb & Company, state that it was for foreign investment. While this may be the case, we understand that much of it will never leave this country. The sale was a very excellent thing for the company, as the block was always regarded as a menace to quotations.

Something over 25 per cent. of the first mortgage five per cent. bonds, of which there is an issue of 3,250,000, have assented to an exchange for the stock. Rights to subscribe will expire June 15. Officers of the company inform me that they expect that 75 per cent. of these bondholders will assent, in which case they will be empowered, under their reorganization, to call for the remaining 25 per cent., also that they will probably act upon this option.

The earnings of the company show a gratifying increase, as will be seen by the accompanying table:

Following is given the statement of earnings for April and for four months:

	1893.	1892.	1891.
Gross Earnings	$102,093	$75,404	$45,812
Operating Expenses	56,153	34,078	24,987
Net	$45,940	$ 41,326	$20,824
Accrued Interest and Bonds	13,541	9,375	8,333
Gross Earnings (4 months)	431,058	311,880	206,596
Net Earnings, (4 months)	210,717	161,894	103,737
Net	220,331	$149,936	$102,859
Accrued Interest and Bonds	53,833	37,500	33,333

Transactions in the less active stock were of an insignificant character. Interior Conduit and Insulating sold on Friday at 47. This is the first transaction which has taken place for some weeks, and is to be compared with 66, the opening price when the stock was listed shortly after the first of the year. There was a little demand for the higher priced telegraph stocks. We note 125 bid for Commercial Cable against 140 last week. There were no offers, although the stock is held from 15 to 30 points above this figure. Postal Telegraph was offered at 76 with no takers. No sales are reported.

The American District Telegraph Company has been granted permission to list 200 shares of its stock on the New York Stock Exchange. On the basis of 60 this stock is worth $12,000. It is to be used for the purchase of the entire capital stock of the District Telegraph and Burglar Alarm Company, of Harlem, which consists of 5,000 shares of a par value of $5 per share. The total amount of this Company's stock now listed is $3,845,000. There still remains in the treasury 1,550 shares. There was but one sale of the stock recorded last week, it being at 53¼.

American Bell Telephone was quite irregular, ranging between 192 and 200. The close was 190½ to 193. The telephone output for the month ending May 20 was as follows:

	1893.	1892.	Inc.	Dec.
Gross output	10,951	10,724	227	....
Returned	5,195	4,592	603	....
Net	5,756	6,132	....	376
Since Dec. 20:				
Gross	43,059	41,212	1,847	....
Returned	23,122	19,196	3,926	....
Net	19,937	22,016	....	2,079

The number of instruments in use May 20 was 572,657, an increase of 41,234 in 12 months.

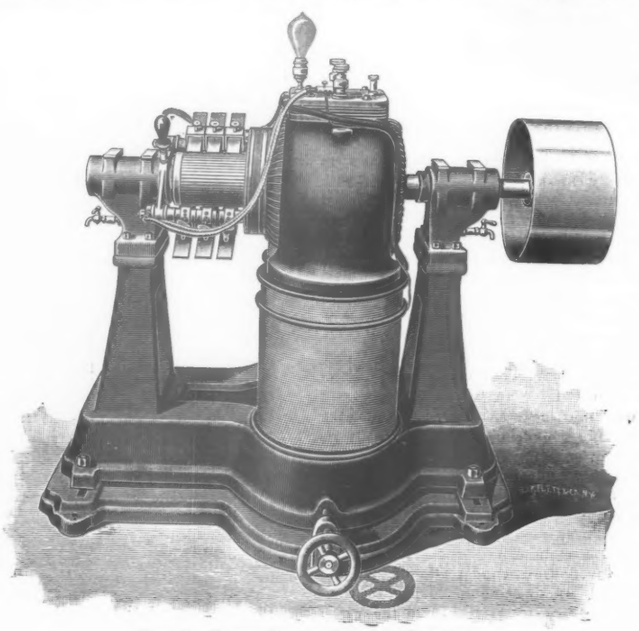
Following is given the highest and lowest prices of the week of the active electric stocks:

	Highest.	Lowest.
Western Union	86	84⅝
" " Col. Trust 5's	105	103
General Electric	79	65
" Debenture 5's	91⅛	84
Edison Electric, Ill.	112	108½
North American	10½	9½
American Dist. Tel.	53¼	53¼
" Tel. and Cable	83½	83
Interior Cond't and Insu.	47	47

New York, May 27.

Judgment was entered in this city last week against the Chatham Electric Light Company, of Chatham, N. Y., for $11,732, in favor of the General Electric Company, for electrical machinery and wares sold in 1890, 1891 and 1892 by the Thomson-Houston Electric Company.

Fire in the State bank building of Keokuk, Ia., last week caused several thousand dollars damage. Every telephone wire in the city is burned off and the service is badly demolished.



NEW LA ROCHE DIRECT CURRENT DYNAMO.

New La Roche Direct Current Dynamo.

The illustration on this page represents the new type of direct current dynamo built by the well known La Roche Electrical Works, of Philadelphia. This has been one of the most successful machines that has ever been turned out of their establishment, and for which they have received a number of duplicate orders, giving great satisfaction wherever placed.

The machine, as will be noticed, is of the motor type with Gramme ring armature of the latest improved construction, thereby reducing the speed very materially. It has all modern improvements with all parts interchangeable and made to gauge. The machine is compound wound and has been designed by Mr. F. A. La Roche. It is so constructed as to stand the most severe abuse that any machine of this kind can be subjected to. It has self-oiling bearings and automatic oil overflow. The brush holders are of a new design and so made that any degree of tension can be secured, and so arranged that a free movement of the brushes around the commutator is allowed.

The commutator is made of specially hardened copper well insulated with mica. It will be noticed that the winding of the machine is peculiar, as any of the coils, either series or shunt, can be removed and new ones put in place without interfering with any other part of the machine. An extra heavy steel shaft is used, allowing no vibration, and permitting the armature to run very close to the pole-pieces, consequently increasing the efficiency of the machine.

At a test of one of these machines it was shown that there was a variation of only 1.3 volts between no load and full load, which is a sufficiently close regulation for any purpose that a machine of this kind may be put to.

Within the last three months this company has installed 15 of these machines in Philadelphia and vicinity, and they are spoken of in the highest terms. The La Roche Company are now making arrangements for an increase in their manufacturing facilities.

GENERAL NOTES.

The Westinghouse Electric and Manufacturing Company now has about 4,000 men on its pay rolls.

A long distance telephone line between Columbus, O., and Cincinnati has just been completed and is now open to the public.

It was quite appropriate in this year of celebration that the "Columbia" Incandescent Lamp Company should win the first round in its battle against the Edison patents. This is the year for Columbus and his namesakes to be on top.

Representatives of the Philadelphia and Allentown Electric Trunk Line have awarded the contract for the construction of the line between Allentown and Hellertown, Pa., a distance of 17 miles, to J. H. Silverman and W. A. Stern, of Philadelphia. The price is $300,000.

The Schuyler Electric Company has been given a five-year contract to light the streets of Hagerstown, Pa., at $80 per light a year. The Schuyler Company state they will sell their plant and hand over the lighting contract to the New York street railway projectors, who now hold a 90 days' option on the plant.

A correspondent from Silver Cliff, Colo., writes: The Wild Girl and High Kicker crystallized lead claims, east of town, have just been sold for $12,000. The Edison storage battery people are the purchasers. A 1,000 ton mill is strongly talked of; also an electric railroad from Florence *via* the lead mines to Silver Cliff.

A terrible accident occurred at Eldora, Ia., last week. The boiler of the electric light plant blew up, totally demolishing the plant, together with two other buildings. Much damage was caused in town by the breaking of plate glass windows, etc., and A. E. Gier was instantly killed and Fireman Templeton badly injured. Both were buried under the ruins. The financial loss will probably exceed $20,000.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

BALLSTON, N. Y.—An electric railway will be built from Ballston to Rock City Falls.

CONNEAUT, O.—A company has petitioned council for a franchise to construct an electric street railway in Conneaut.

OMAHA, NEB.—The East Omaha Street Railway Company has been incorporated by John Lowber Welsh and E. T. Stotesbury, of Philadelphia, Pa.; George W. Holdredge, Henry W. Yates and A. S. Potter, of Omaha. The company is capitalized at $1,000,000.

DUBUQUE, IA.—The General Electric Company, of Boston, has bought the Eighth Street and West Dubuque Street Railway line. The Boston company will put in $200,000 worth of its best equipment.

ADRIAN, MICH.—The common council of Adrian has been asked for right of way for an electric railway to be built between that city and Tecumseh.

ASBURY PARK, N. J.—The Monmouth County Sea Shore Electric Railway Company has been organized to construct an electric line from Long Branch to Asbury Park, Ocean Grove, Belmar and Point Pleasant.

MIAMISBURG, O.—The council has granted the Dayton Traction Company a 25-year franchise.

NIAGARA FALLS, N. Y.—The Niagara Falls and Suspension Bridge Street Railroad Company by mortgaging its property has raised $1,000,000. The money will be spent in enlarging and improving the system.

PUEBLO, COLO.—The Union Street Railway Company; capital, $100,000. Incorporators, G. E. Bragdon, J. T. Higgins, C. F. Ray and E. J. Wilcox.

RIVERSIDE, CAL.—Local and eastern capitalists are engaged in agitating the establishment of an electric railway system for the 15 miles of street railway lines in this city.

TOWANDA, PA.—The Towanda Traction Company has been incorporated with a capital of $42,000.

BELLOWS FALLS, VT.—The scheme for an electric railroad between Bellows Falls and Saxton River is being revived again. The company holding the charter will build if the citizens subscribe for $24,000 worth of stock.

NEW YORK CITY.—The Union Electric Railway Company, of this city, has completed arrangements whereby it becomes the possessor of the entire lines of the Westchester Electric Company.

SCRANTON, PA.—The Scranton Traction Company has acquired a controlling interest in the Valley Passenger Railway Company, which has a franchise to build a street railway in Scranton. The Traction Company will complete the lines.

IOWA CITY, IA.—The city council has granted an eastern firm a franchise to build an electric railway, and the firm has made a proposition to construct a road to cost between $40,000 and $50,000, provided the citizens' take stock to the amount of $15,000.

DENVER, COLO.—The Pleasure Resort Railway Company has been incorporated to build an electric line from North Denver to Rocky Mountain Lake. Incorporators, L. G. Kimball, E. C. Skiles and William Thorne.

COVINGTON, KY.—The Cincinnati and Covington Electric Railway Company; capital, $25,000, has been incorporated by O. J. Carpenter, F. P. Helm, John Dorsel and J. H. Mersman. The company will build an electric air line from Covington to Erlanger, Ky.

TROY, N. Y.—The Troy City Railroad Company has petitioned the common council of Cohoes for permission to change the power of the Troy and Cohoes horse railroad to electricity.

HAMMONDVILLE, PA.—The Mt. Pleasant and Hammondville Electric Street Railway Company; capital, $18,000. Incorporators, D. P. Lowe, I. J. McWilliams, Monroe Morrison, F. H. Sheppard, V. B. Hubbs and H. C. Morrison.

MUNCIE, IND.—The Muncie Electric Railway Company; capital, $200,000. Incorporators, W. C. Nichols, Aretus W. H. Hatch, Andrew T. Hart, Lewis Wallace, Jr. and James C. Devor.

Electric Light and Power.

CHATTANOOGA, TENN.—The General Electric Company, of Boston, which controls the Chattanooga Electric Light Company, will spend about $150,000 for the erection of new electrical works in Chattanooga.

RHINEBECK, N. Y.—The Rhinebeck Electric Light and Power Company, of Rhinebeck; capital, $5,000. Directors, Thomas J. Swift and James L. Williams, of Poughkeepsie, and Allen H. Hoffman, of Rhinebeck.

MACON, GA.—Macon, Ga., is contemplating a bond issue of $500,000 to pay for electric light and water works.

MAYFIELD, PA.—The Lackawanna Valley Electric Light and Power Company has been incorporated with a capital of $150,000.

NIAGARA FALLS, N. Y.—The Niagara Falls Electric Company, to furnish light and power in Niagara Falls; capital, $20,000; Incorporators, G. W. Daggett, of Nunda; George A. Krupp and Samuel Ames, of Buffalo.

WARRENTON, MO.—The Warrenton Electric Light Company; capital, $5,000. Incorporators, C. E. Peers, W. L. Morsey and B. Lovesay.

MILFORD, ILL.—The Milford Electric Light and Power Company; capital, $15,000. Incorporators, Henry V. Brown, Eugene W. Whipple and William H. Megg.

AKRON, N. Y.—A number of residents talk of organizing a company and putting in an electric light plant.

NEW KENSINGTON, PA.—The Allegheny Valley Heat, Light and Power Company has been chartered. Capital, $15,000.

ATHENS, PA.—The Tioga Point Electric Light and Power Company; capital, $3,000, has been incorporated.

SAYRE, PA.—Articles of incorporation have been filed by the Electric Light and Power Company, of Sayre. Capital, $3,000

PERRYVILLE, MD.—There is every probability that the next legislature will be petitioned to grant a charter to a company for the erection of an electric light plant in Perryville.

CENTRALIA, ILL.—The Centralia Light and Power Company; capital, $31,000. Incorporators, F. Kohl, George L. Grittinger and Seymour Andrews.

New Manufacturing Companies.

PITTSBURGH, PA.—The Westinghouse Electric Company will build large electrical works in Wilmerding Pa., at an estimated cost of $500,000.

MILWAUKEE, WIS.—The Northwestern Electrical Manufacturing Company; capital, $10,000. Incorporators, John Z. Westervelt, Lee Peck and Daniel L. Case.

CHICAGO, ILL.—The Pumpelly-Sorley Storage Battery Company; capital, $500,000. Incorporators, Jessie Rowe, George H. Jenney and Harriett M. Gibbs.

NEW YORK CITY.—The Electrical and Mechanical Manufacturing Company; capital, $15,000. Incorporators, Henry B. Oakman and Joseph W. Oakman, of Brooklyn; John D. Stark, Ira Darrin and Charles A. Tipling, of New York city. The company will manufacture, buy, sell and deal in mechanical and electrical appliances.

WADESTOWN, W. VA.—The Wadestown Telephone Company has been incorporated by T. W. Barr, C. C. Harter, C. L. Elkins, Asa Henderson and N. G. Garrison. The company will build telephone lines from Wadestown to Burton, Blackstown, Morgantown, Fairmount, Mannington and intermediate points.

UTICA, N. Y.—The Utica Subway Company; capital, $10,000. Incorporators, W. B. Crouse, John R. Baxter, Thomas F. Baker, Wm. W. Fowler and Francis M. Kendrick. The company is organized to construct and maintain subways for telegraph, telephone, electric light and other wires.

DES MOINES, IOWA.—The Iowa Electric and Construction Company; capital, $100,000. Incorporators, A. T. Hess, J. A. James, J. Steadman, E. C. Spinney and E. G. Pratt.

LYNN, MASS.—The General Electric Company has had plans made for three more buildings to be erected at its works in this city.

ELECTRIC LIGHT FLASHES.

An electric light company is being formed at McDonald, Pa.

Port Washington, Wis., is soon to be lighted with arc lights.

Odebolt and Waverly, Iowa, are discussing the electric light question.

Reynoldton, N. J., is wrestling with the electric light problem, and the borough may yet build a plant of its own.

Contracts for the building of an electric light plant at New Castle, Col., will be let by the council of that burg this week.

The Edison Light and Power Company, of Boston, has declared a monthly dividend at the rate of eight per cent. per annum.

The town of Madison, Me., has voted to build an electric light plant and secure a water power to operate it. A loan of $15,000 has been authorized.

The Edison Electric Light Company, of Grand Rapids, Mich., has begun excavations for the extensive annex to its plant which will be erected next summer.

The Cleveland General Electric Company asked the board of control last week for permission to lay iron conduits in the down town streets for electric light wires. The request was referred to the directors of public works and fire.

The Edison Electric Light Company filed, last week, in the District Court of St. Louis, a motion that the bond exacted from the Columbian Incandescent Lamp Company by Circuit Judge Hallett be increased. The complainant was given until May 20 to file affidavits in support of his motion.

At a recent meeting of the Board of Trustees of Holley, N. Y., a contract was entered into with the Holley Electric Company for lighting the streets of the village for a period of five years for a compensation of $1,100. The total number of incandescent lights to be used is 84. The number used under the former contract was 62. The Holley Electric Company has purchased a new plant complete of the Westinghouse Company at an outlay of about $4,000.

Experiments with High-Frequency Discharges.

Mr. A. A. Campbell Swinton, the author of a recent paper in the *Philosophical Magazine*, has succeeded in passing through his body, from hand to hand, sufficient electricity to bring the filament of an ordinary five candle-power 100 volt incandescent lamp very nearly to full incandescence, and found that practically no sensation resulted from the transmission. The apparatus used consisted of a large induction coil coupled to three Leyden jars whose disruptive discharge excited the primary of a high frequency induction coil. The secondary of this induction coil had its terminals in two brass balls, to which the wires were led through glass tubes filled with oil. One of the terminals may be grasped with impunity, and hardly any sensation is felt; and while thus in contact sparks will pass to any conductor placed near enough. If the free hand, holding a metal rod, be approached to the terminal of an incandescent lamp, as described above, whose other terminal is earthed, the lamp is first filled with phosphorescent light, then sparks pass and the lamp glows, and on making contact the lamp reaches very nearly its full incandescence. The author believes that this result is due, not to the passage of the full normal current through the body (its effect being not felt owing to the exceedingly high frequency), but to the fact that the amperes taken are actually much less, owing to the crowding of the current to the outer surface. The virtual resistance is thus very high and increases the voltage of the lamp; and thus a much smaller current enables the lamp to receive enough energy to produce incandescence. This explanation is confirmed by the fact that while the lamp was glowing sparks passed between its terminals, thus proving that a very high P. D. existed of the order of thousands of volts.

Other curious results were obtained. If the connection from the secondary coil to the lamp were made by a wire, instead of utilizing the body, the lamp reached more than its normal candle-power; thus showing that the body offers resistance to the passage of the current. To estimate this resistance the thumbs of the connecting man were approached, and sparks about one-quarter inch long passed, showing a P. D. of some thousand volts. If the hands were brought into contact so as to short circuit the man, the lamp became appreciably brighter. Placing the body in parallel with the lamp between one terminal of the high frequency coil and earth, the lamp was reduced to less than half its brilliancy, the two impedances being apparently about the same. If one terminal of the lamp were connected to the coil and the other were touched by a piece of metal held in the hand of the insulated or uninsulated operator, the lamp glowed. The effect in this case is due to the capacity of the gentleman in question. These experiments were made with the other terminal of the high frequency coil free; if it were earthed or touched by another operator, the brilliancy of the lamp was diminished. Again, the incandescence was diminished if the lamp was connected directly across the terminals of the lamp; and if the operator occupied a similar position the sensation was quite unbearable. The author concludes, therefore, that capacity has much to do with the results obtained, and that the physiological effects of electric currents are not necessarily proportional to their heating power.

Secretary Lamont's attention has been called by the G. A. R. to what they have claimed is a threatened injury to the historic battlefield, at Gettysburg, Pa., by the construction of a trolley road over the principal parts of the park, and he has practically decided to protect the interest of the government in the matter. He will soon appoint a committee of officers to superintend the marking of the lines of battle, and has instructed Acting Judge Advocate General Lieber to ascertain the full extent of the government's rights in the premises. In the opinion of many army officers who have investigated the subject, there is no doubt of the powers of the government to take complete charge of the field under that portion of the Sundry Civil bill which appropriates so much money for the preservation of the battle lines.

KINDRED INTERESTS

"How to Obtain Dry Steam" is the title of an interesting little pamphlet put forth by the Pond Machinery Company, 709 Market street, St. Louis, Mo.

Travelers to Boston and vicinity are advised to purchase tickets *via* the Providence and Stonington Steamship Company's routes, either to Providence or Stonington, and from there by rail.

The Railway Equipment Company, Pullman Building, Chicago, Ill., has just issued a remarkably complete and well arranged catalogue of electric railway supplies for all systems.

The Manhattan Electrical Supply Company, 36 Cortlandt street, New York, has issued a handy pocket edition of its catalogue and price list of electrical novelties, electrical house furnishing goods and standard electrical supplies.

Waterhouse, Gamble & Company, 302 Asylum street, Hartford, Conn., have sent out a neat catalogue describing their arc lamps with atmospheric clamp clutch feed for incandescent and arc circuits. The New York office of this company is at Room 176, No. 45 Broadway.

The Bishop Gutta Percha Works, of this city, shipped to Chicago last week the submarine cable which will carry the alternating current to the buoys in Lake Michigan marking a "fair way lane" from the city proper to the World's Fair grounds. This buoy system was described in full in a recent issue of the ELECTRICAL REVIEW.

The Interior Conduit and Insulation Company, 44 Broad street, New York, have just issued two new and handsome catalogues, one describing the 1893 models of the Lundell fan motors which made such a cooling impression last season, and the other giving the latest information about interior conduit and accessories for safe wiring.

The Chapman Valve Manufacturing Company, of Indian Orchard, Mass., has located its World's Fair exhibit in Machinery Hall, Section Main 26, Space K-28. The exhibit includes this company's well-known straightway valves and fire hydrants, and the Jackson Park power station of the Western Dummy Electric Railroad is fitted throughout with Chapman valves.

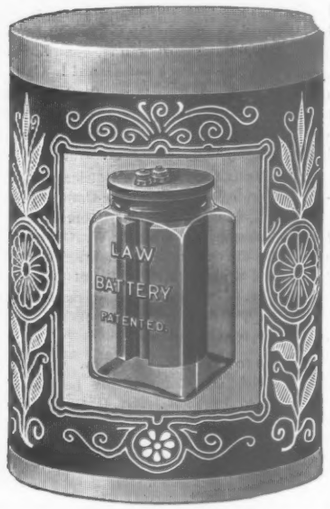
Fred. A. Scheffler, 74 Cortlandt street, New York, general sales agent for the Stirling Company, reports the following recent sales of Stirling water tube safety boilers: Edison Illuminating Company, Bellefonte, Pa., 125 horse-power; Edison Illuminating Company, Martinsburgh, W. Va., 400 horse-power; Lehigh Coal and Navigation Company, Lansford, Pa., 400 horse-power; Pope Mill, Providence, R. I., 100 horse-power; Consolidated Smelting Company, of Kansas City, Argentine, Kan., 250 horse-power.

The Elektron Manufacturing Company.

The Elektron Manufacturing Company are experiencing a very lively demand for their improved electric elevators; and for the convenience of customers in that vicinity they have recently opened an office at 103 Milk street, Boston, and have stationed there Mr. E. Marshall, as manager of the elevator department, and Mr. F. B. Corey, as manager of the electrical department. These two gentlemen are both experts in their particular departments and will handle successfully any business that may come their way. Mr. Marshall has had a long experience in the elevator business in connection with the Otis and Graves hydraulic and power apparatus. The Boston office has recently installed electric elevators for Messrs. Curtis & Bolster, 2304 Washington street, Boston, and Frank Ferdinand, 2280 Washington street, Boston. The main office of the Elektron Company, at Springfield, has recently sold electric elevators to the new Masonic Hall, Springfield, Mass., the finest building in the city; Brown, Thompson & Company, dry goods store, Hartford; W. H. King & Son, paper dealers, Springfield. The latter is the second order from these parties.

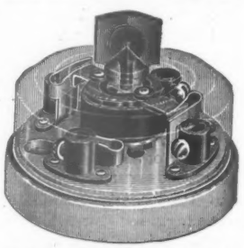
Increasing Towing Power.

On some of the French water courses a system of chain haulage has been adopted to assist steam tugs in towing barges up the river against the stream. Briefly, the chain, which is fastened at each end, lies at the bottom of the river. It passes between guides at the stern or bow of the tug, over rollers and guides, and round nearly the whole of the circumference of the haulage pulley or drum, which is driven by gearing from the engines. Leaving this pulley the chain passes over a similar series of rollers between braking pulleys, and then is permitted to fall again into the river. With a view to increase the speed of the tug, a system of magnetic adhesion has been devised by M. Bovet, and has recently been tested on the Seine. It consists essentially in combining in the haulage pulley a magnet, the upper sides of the groove forming powerful pole pieces, which are short circuited when the chain engages in the groove. By this means the pull on the chain and therefore the speed of the boat are increased. One of the towing companies on the Seine is said to have adopted this system.



Do You Need Anything in the Line of
BATTERY SUPPLIES?
We Can Quote You Bed-Rock on
Carbons, Zincs, Coppers,
Jars, Sal-Ammoniac,
Blue-stone, etc.
WRITE US FOR PRICES.
Law Battery Company,
85 JOHN STREET, NEW YORK.

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

HART SWITCHES

10 Ampere Double Pole Switch.
The Hart & Hegeman Mfg. Co.,
HARTFORD, CONN.

ENGINE CASTINGS

from one-eighth to six horse power Horizontal & Marine.
5, 10 & 60 LIGHT DYNAMO CASTINGS.
Simple Sewing Machine and Fan Motor Castings with instructions for building complete machines.
Send Stamp for Catalogue
PALMER BROS., Electrical Supplies, Mianus, Conn.

ROSE POLYTECHNIC INSTITUTE,
Terre Haute, Ind. A College of Engineering. Well endowed, well equipped. Courses in Mechanical, Electrical, Civil Engineering, and Chemistry. Extensive Machine Shops, Laboratories, Drawing Rooms, Library. Expenses low.
Address, H. T. Eddy, Prest.

Established 1847. Purely Mutual.
INSURE IN
The PENN LIFE Company,
— OF —
PHILADELPHIA, PA.
WHY?
IT IS THE BEST!
Assets, - - $18,551,388.30
Surplus, - - 2,465,689.13
Apply for Rates to
EZRA DE FOREST, Gen'l Agent,
181 BROADWAY, NEW YORK.

WANTED.
A Man of experience in soliciting and electrical construction work, to take charge of department; must be active, able to estimate and push workmen.
ADDRESS
P. O. Box 727, Baltimore, Md.

SPECIAL,
GANDELABRA
AND MINIATURE
INCANDESCENT LAMPS.
For information and prices covering Special, Candelabra and Miniature Incandescent Lamps, address the
EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
HARRISON, N. J.

Telephone Lines
. . . AND . . .
Their Properties.
BY PROF. WILLIAM J. HOPKINS.
258 PAGES, ILLUSTRATED, PRICE, $1.50.
(Extract from Preface.)

"The subject of exchanges has been taken up principally to round out the scope of the book; and for much of the matter under this head I am indebted to the writings of Messrs. A. S. Hibbard, F. A. Pickernell and J. J. Carty.

"In covering the ground which comes most properly under the title, the properties of telephone lines, I have endeavored, so far as possible, to avoid mathematics, and to treat the subject in a way which would prove most interesting and instructive to the general reader as well as to the student. Where it has seemed best to put in a mathematical demonstration, it has been put in a footnote.

"The results of investigations in regard to the properties of telephone lines, I have endeavored to state clearly in a general discussion. They are not susceptible of tabulation, and the most important properties it is impossible to formulate exactly.

"I have treated rather fully the questions of interference with the telephone currents from outside sources, especially the troubles from electric railways; for my practice in that direction, during the last four or five years, has been considerable, and enables me to deal with that subject in the light of personal experience. This question is still of considerable importance in this country, and its treatment here may be of assistance to managers of exchanges in practical work.

"It was my intention that the book should be one which would prove useful to the practical man, as well as that it should serve as a basis for a lecture course to students. I have therefore thought it best to introduce some matter in which correct elementary ideas of matter and energy are developed, so as to lead up to the most modern conception of the method of propagation of electro-magnetic disturbances."

Sent to any address on receipt of price.

Electrical Review Publishing Co.,
13 PARK ROW,
NEW YORK.